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Vol 1, Issue 2, Ocotber 2016

JOURNAL OF COCHIN PERIODONTISTS SOCIETY

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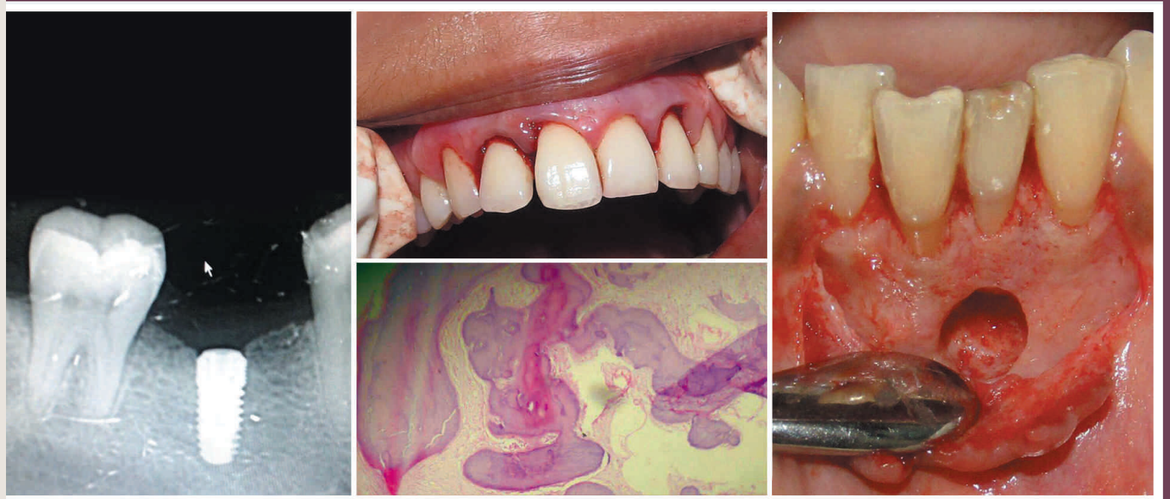

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JOURNAL OF COCHIN PERIODONTISTS SOCIETY

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COCHIN PERIODONTISTS SOCIETY

COCHIN PERIODONTISTS SOCIETY (COPS)

Born in an informal meeting of 11 Periodontists of IDA Cochin branch on 3rd August 2004 COPS has today grown to one of the best regional professional societies in the field of dentistry in the state of Kerala. Over this period, COPS has served as a platform for more than 60 Professional Enrichment Programs including several state level conferences. COPS played an integral role in hosting the national conference of Indian Society of Periodontology in the year 2013. Having majority of its members as active academicians serving across the state, it was a dream of the society to have a scientific journal of its own, which is realized through Jcops, the official publication of Cochin Periodontists Society.

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JOURNAL OF COCHIN PERIODONTISTS SOCIETY (Jcops)

The Journal of Cochin Periodontists Society (Jcops) is the official publication of Cochin Periodontists Society. It is an initiative of the academic members of the COPS who works as undergraduate and postgraduate guides and teachers at various institutions across the state of Kerala. The journal has an equal affinity for articles with exclusive and interdisciplinary nature in the subject of Periodontology.

Every clinical procedures and research works in the subject of Periodontology serve confidence to other specialities also. This is the basis of having its unique interrelationship with other specialities of dentistry. Jcops helps the clinical practitioners of every dental specialities to publish their extra ordinary case reports , research works and reviews here to share its benefit to promote the scope of interdisciplinary dental practice. The diagnostic and therapeutic fields of oral diseases like Oral medicine and Oral pathology and Interdisciplinary fields like restorative dentistry &Implantology has a special place in the practice of Periodontology, hence articles pertaining to these specialities are also given equal importance in the journal. In short, Jcops understands that knowledge and skills of each specialists shared through such journals serves as cogs that deliver harmony and perfection in dental treatment.

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Jcops will be circulated free of cost among all its life and associated members and every speciality departments of dental colleges across the state and major dental colleges across the country. This professional society journal is framed within the objective of supporting clinical practice, education and research in the field of dentistry.

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EDITORIAL

Warm wishes to all readers of Jcops

Today's article - Tomorrow's reference!!!

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There is only a relative demarcation between past, present and future. Unless found worthy, no information gathered in past is carried to future. Authentic literature in medical science was a feeble database till recently, with few standard text books and journals monopolizing the review of literature world. Having a direct access to numerous search engines & online libraries, today anyone can publish their interests, whether it is aimed at learning, training or guidance.

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ORIGINAL RESEARCH

Root dentine hypersensitivity following hand Vs ultrasonic instrumentation: A randomized clinical trial

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ABSTRACT:

Background: The study aimed at comparing the degree of root dentine hypersensitivity following Scaling and Root planing using Hand vs Ultrasonic instruments.

Materials and Methods: 15 out-patients with mild to moderate chronic periodontitis were included in this clinical trial. After probing depth evaluation, two quadrants were randomly allotted for either hand or ultrasonic instrumentation. Root dentine hypersensitivity was recorded using an air-blast derived from a 3 way syringe. Baseline Visual Analogue Scale (VAS) and plaque scores were recorded. One quadrant was instrumented with Gracey curettes and other with ultrasonic scalers. Patients were recalled after 1st, 2nd and 3rd week. At every visit VAS and plaque scores were recorded.

Results: No statistically significant difference in mean total VAS scores between teeth instrumented with hand instruments and ultrasonic instruments in all visits ($p > 0.05$).The mean total VAS scores peaks from baseline to 2nd week and gradually falls by 3rd week in both the groups.

Conclusion:

No statistically significant difference in root dentine hypersensitivity between teeth instrumented with ultrasonic and hand instruments after scaling and root planing.

Key words: Root dentine hypersensitivity, ultrasonic instruments, Gracey curettes.

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Conflict of Interest: None declared

Source of Support: Nil

INTRODUCTION:

Chronic Periodontitis is an inflammatory disease of periodontium characterised by inflammation of the gingiva and adjacent attachment apparatus, illustrated by loss of clinical attachment due to destruction of periodontal ligament and loss of alveolar bone.[1] Periodontitis is a bacterial plaque induced multifactorial disease. The successful treatment of periodontitis depends on the effective removal of bacterial deposits from the tooth surfaces.[2] This can be accomplished through oral hygiene measures by the patient [3] and by professionally performed mechanical debridement every six months.[4]

Professionally performed mechanical debridement is done commonly with hand instruments or with ultrasonic instruments. Clinical findings indicate that similar treatment outcomes were obtained with hand and sonic or ultrasonic instruments.[5,6] The iatrogenic exposure of root dentine due to removal of the cementum layer is one of the complications due to scaling and root planing which leads to exposure of dentinal tubules.[7]

As a result, the patient may experience increased sensitivity of the exposed root surfaces to thermal, tactile, evaporative and osmotic stimuli. This pain condition, when severe, has been termed in the literature as dentine hypersensitivity (DH), which is a well-known ailment to the clinician.[8]

Although, studies had been done to evaluate root dentine hypersensitivity following non surgical therapy and studies comparing root dentine hypersensitivity following non surgical therapy [9,10] and surgical therapy [11,12] had been done, very few studies compared the root dentine hypersensitivity following ultrasonic and hand instruments.

In this randomized clinical trial, we had compared the degree of root dentine hypersensitivity developed following scaling and root planing using hand instruments vs ultrasonic instruments.

MATERIALS AND METHODS:

This randomized clinical trial was approved by Institutional ethical committee review board of Sri Ramakrishna Dental College and Hospital, Coimbatore on August 2015. The study was conducted during September 2015 to January 2016. 15 patients with mild to moderate chronic periodontitis from out-patients who had visited Department of Periodontology, Sri Ramakrishna Dental College and Hospital, Coimbatore, were included in this clinical trial. Inclusion criteria for participation were the need for periodontal treatment in at least 2 quadrants comprising a minimum of 4 teeth with vital pulps, but no open carious lesions. Patients with history of dental treatment in the last 3 months and patients with ongoing treatment for root dentine hypersensitivity were excluded from the study. Crowned teeth and the teeth used as abutment for removable prostheses were excluded. Informed consent was obtained from the patients participated in the study. Plaque scores were obtained in all quadrants before scaling and root planing. Recording of clinical parameters and, scaling and root planing are performed by single operator.

After evaluating the probing depth, two quadrants with mild to moderate periodontitis were selected for instrumentation. Root dentine hypersensitivity was recorded using an air-blast (60 psi) derived from a dental syringe which was directed perpendicular to the root surface for one second. During testing the dentist's gloved fingers shielded the neighbouring teeth. After this stimulation the patient was asked again to score the discomfort. The perceived discomfort for each tooth was graded for each of the two stimuli by using a 100 mm VAS, labelled at the two extremes with "no pain" at the zero extreme and with "unbearable pain" at the 100 mm extreme. Baseline Visual Analogue Scale (VAS) scores[13] and plaque scores[14] were recorded. The quadrants were randomly allotted for either hand or ultrasonic instrumentation by tossing a coin. One quadrant was instrumented with Gracey curettes and other quadrant with ultrasonic scalers (EMS piezoelectric Scaler) under local anaesthesia. Patients were instructed to follow Modified Bass brushing technique and interdental cleaning aids were also prescribed when needed. Patients were recalled after 1st week, 2nd week and 3rd week. At every visit VAS scores and plaque scores were recorded. All the patients were prescribed with Chlorhexidine mouth wash 0.2% after scaling and root planing. None of them were prescribed with analgesics.

STATISTICAL ANALYSIS:

Sample size was determined as 30 by using the formula $n = t^2 \times p(1-p)/ m^2$, where n is the required sample size, t is the confidence interval and it was set as 95%, p is the expected frequency of factor under study and it was set as 2%, m is the margin of error and it was set as 5%. The data were reported as the mean +/- SD or the median, depending on their distribution. The differences in quantitative variables between groups were assessed by means of the unpaired t test. Comparison between groups was made by the Non parametric Mann - Whitney test. ANOVA was used to assess the quantitative variable. Scheffe Post hoc test was performed. A p value of < 0.05 using a two-tailed test was taken as being of significance for all statistical tests. All data were analysed with a statistical software package. (SPSS, version 16.0 for windows)

RESULTS:

There was a statistically significant reduction in mean total plaque scores from baseline (4.72) to 3rd week (3.07) in all the patients (Figure 1, 2 and Table 1). The mean total visual analogue score was high in teeth instrumented with hand instruments when compared to ultrasonic instruments in all visits but not statistically significant ($p > 0.05$) (Table 2). The mean total Visual Analogue Score peaks from baseline to 2nd week and gradually falls by 3rd week in both the groups (Figure 3). Correlation between total mean plaque score and total mean analogue score was also analysed (Table 3). Positive correlations present between total mean plaque score and total mean analogue score during baseline and during 3rd visit. Negative correlation present between total mean plaque score

and total mean analogue score during 1st and 2nd visit.

DISCUSSION:

The present study had been conducted to compare the degree of root dentine hypersensitivity developed following scaling and root planing using hand instruments vs ultrasonic instruments. Significant reduction in mean total plaque scores from baseline (4.72) to 3rd week (3.07) was observed in all the patients. The results of the present clinical trial demonstrated that the intensity of root dentine sensitivity (RDS) decreased from baseline to 3rd week in both groups when no repeated root instrumentation had been performed and meticulous plaque control was maintained.

In our study, mean total VAS score peaks from 1st week to 2nd week and declined gradually by 3rd week. This is in accordance with Tammaro et al [10] who demonstrated decrease in VAS score after two weeks follow up. But this is contradictory to Fischer et al [15] who reported that the pain threshold level decreased within one week following subgingival instrumentation. On the other hand, Wallace & Bissada[11] observed no significant change in root sensitivity after scaling and root planing.

In our present study there was a positive correlation between mean total plaque scores and mean total visual analogue score in all patients during baseline and 3rd week and negative correlation during 1st and 2nd week. This shows that even when meticulous plaque control was done by all patients root dentine hypersensitivity was always a side effect of scaling and root planing temporarily. No analgesics were given to the patients in this study to evaluate the effect of plaque control alone on root dentine sensitivity. The design of the present study was such that it allowed for sequential, repeated assessments of root dentine hypersensitivity in the treated quadrants. During the 1st, 2nd and 3rd week follow-up after scaling and root planing, no statistically significant difference in the mean VAS scores were observed between hand instrumentation and ultrasonic instrumentation (p>0.05).

CONCLUSION:

No statistically significant difference in VAS scores had been reported between ultrasonic and hand instrumented groups following scaling and root planing in all follow-up-visits. Further studies with more number of participants and extended follow up is necessary to substantiate the findings of the study.

FIGURE 1:

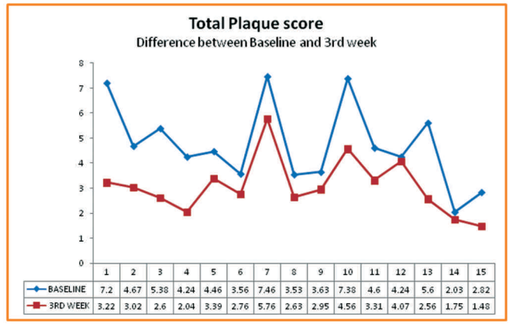
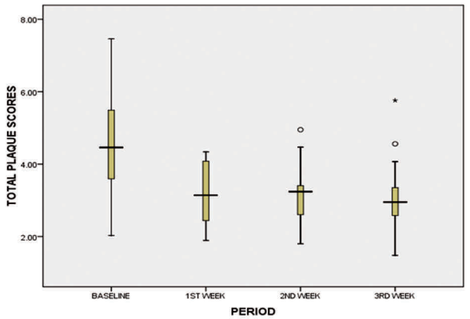


Fig. 2: Mean total plaque scores at baseline and all follow-ups



Mean Total Plaque score of Study Groups

Group	Mean Scores	SD	95% CI for Mean		Minimum	Maximum	Sg
			Lower	Upper			
BASELINE	4.72	1.63	3.82	5.62	2.03	7.46	
1ST WEEK	3.14	0.89	2.65	3.64	1.89	4.34	<0.01
2ND WEEK	3.15	0.83	2.69	3.61	1.8	4.95	<0.01
3RD WEEK	3.07	1.09	2.47	3.68	1.48	5.76	<0.01
Total	3.52	1.32	3.18	3.86	1.48	7.46	<0.001

TABLE 1

Table 2. Mean of Total Visual Analogue scores of Hand Instrument and Ultrasound Instrument at different follow-up

Group	Mean Scores	Mean	SD	95% CI for Mean		Minimum	Maximum	Sg
				Lower	Upper			
BASELINE	Hand	1.7	3.1	0.0	3.4	0	10	
	US	1.0	2.8	-0.6	2.6	0	10	>0.05
	Total	1.3	2.9	0.2	2.4	0	10	
1ST WEEK	Hand	4.7	6.4	1.1	8.2	0	20	
	US	3.7	4.8	1.0	6.3	0	15	>0.05
	Total	4.2	5.6	2.1	6.3	0	20	
2ND WEEK	Hand	8.0	8.2	3.5	12.5	0	20	
	US	6.0	4.7	3.4	8.6	0	15	>0.05
	Total	7.0	6.6	4.5	9.5	0	20	
3RD WEEK	Hand	5.7	7.0	1.8	9.6	0	20	
	US	4.3	5.6	1.2	7.5	0	15	>0.05
	Total	5.0	6.3	2.7	7.4	0	20	

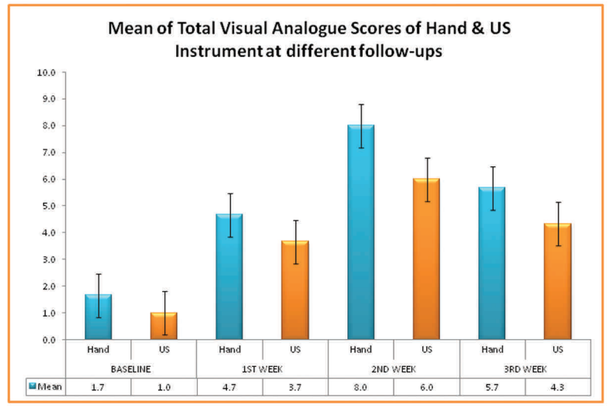


FIGURE 3:

PERIOD OF EVALUATION	NUMBER OF PATIENTS	CORRELATION	SIGNIFICANCE
BASELINE	15	0.121	0.666
1ST WEEK	15	-0.129	0.647
2ND WEEK	15	-0.256	0.357
3RD WEEK	15	0.135	0.632

TABLE 3: Correlation of Total Plaque scores & Total visual analogue score at different follow-ups.

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ORIGINAL RESEARCH

Morphological variations of mandibular first premolar in Kerala population using cone beam computed tomography: An in –vitro study

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Date of acceptance: 2 -08- 2016

ABSTRACT:

Aim: To assess the variations in root canal morphology of mandibular 1st premolar teeth in Kerala population using CBCT .

Material and methodology: 40 extracted mandibular 1st premolar teeth for orthodontic treatment at different dental clinics, private hospitals and dental colleges of Kerala population were collected and stored in formalin solution. Teeth samples arranged in occlusal rims and scanned by CBCTscanning (SIRONA ORTHOPHOS XG SCANNING machine) and analyzed using Galilio software.

Results: Out of 40 samples studied 17 teeth showed bifurcation of canals and 23 teeth had no bifurcation. Canals with bifurcation were 42.5% compared with teeth with single canal (57.5%).

Conclusion: Observations of the current study confirmed the presence of ethnic differences among various races and provided some information about the internal anatomy of the mandibular first premolar in Kerala population. Endodontists and dental clinicians can use such information to achieve a better prognosis for root canal treatment.

Keywords: Bifurcation, mandibular, CBCT scanning, root canal, occlusal

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Conflict of Interest: None declared Source of Support: Nil

INTRODUCTION

Successful endodontic treatment depends on complete canal cleaning and shaping and 3-dimensional obturation. The lack of proper knowledge about the anatomy of root canals is one of the main reasons for endodontic treatment failures. So the main step in achieving successful endodontic outcome is an exact diagnosis of root canal system and its anatomical variations. Any attempt to perform endodontic therapy must be proceeded with a thorough understanding of the anatomy of both the

pulp chamber and root canal system.[1]

Mandibular 1st premolar shows a considerable variation in root canal morphology. The internal anatomy of mandibular 1st premolar is particularly complex due to their variation in the number of roots and canal configuration.

Studies on root canal anatomy are usually done by radiography, clearing technique, plastic resin injection technique, and direct observation with microscope and macroscopic sections. Conventional radiography has the problem of superimposition and moreover it is a two dimensional representation of a three dimensional object. The difficulties associated with other methods of study include disturbance of pulp space and its surrounding structures during preparation of the teeth.

All races and ethnic groups have some degree of dental anatomic variations. Asian populations shows one of the widest variations in coronal shape, external root form and canal morphology (Thews et al.1979, Harris 1980, Ross&Evanchik 1981, cecic et al.1982, Yang et al. 1988). Aim of this invitro study was to assess the variations in root canal morphology of mandibular 1st premolar teeth in Kerala population using CBCT.

MATERIALS AND METHODS

In this invitro study 40 extracted mandibular 1st premolar teeth for orthodontic treatment at different dental clinics, private hospitals and dental colleges of Kerala population were collected and stored in formalin solution.

- INCLUSION CRITERIA: Teeth with mature root apex irrespective of age and sex
- EXCLUSION CRITERIA: Teeth with open apex, complicated fracture, external root resorption communicating with root canal or grossly damaged teeth were discarded.

All attached soft tissues and calculus are removed by using an ultrasonic scaler.Modelling wax were used to make occlusal rims and the teeth were arranged after determining the various aspects of the tooth i.e., Buccal, lingual, mesial and distal, so as to maintain uniformity in the samples.

Figure 1-Teeth Sample

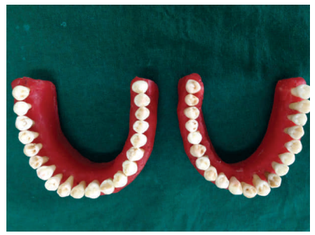

Figure 2- Teeth arranged in Occlusal Rim

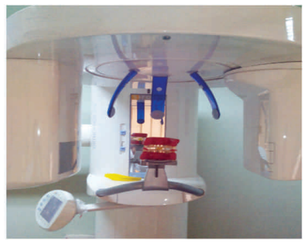

Figure 3- Teeth samples in Scanning Machine

A total of 2 wax blocks were needed for arranging all the 40 teeth. The two wax blocks having teeth arranged is placed in CBCT scanning machine as like upper and lower jaw together. The two blocks were stabilized together by placing sticky wax in between teeth. The teeth were scanned using SIRONA ORTHOPHOS XG SCANNING machine and analyzed using Galilio software.

DISCUSSION

CANAL PATTERN

Weine categorized the root canal systems in any root into four simple and directly clinically oriented classifications. Vertucci utilizing cleared teeth which had their pulp cavities stained with hematoxalin dye & found a much more complex canal system and identified eight pulp space configurations. Canal pattern were analyzed using Vertucci's classification in this study because it is commonly used by authors in the literature and textbooks.

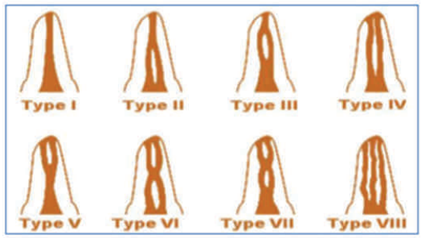

Figure 4- Vertucci's types of canal pattern

In 1984, Vertucci[2] determined canal numbers and configurations by percentages for each of the human permanent teeth and this can be considered as a baseline point for root canal anatomy comparison.[3] In this study out of the 40 samples studied,23teeth (57.5%)showed Vertucci's classification I configuration, 11 teeth(27.5%) samples showed Vertucci's class III and 6 teeth showed type V(15%).

Table 1- canal patterns observed

Type of canal	Frequency	Percentage
I	23	57.5
III	11	27.5
V	6	15
Total	40	100

The result of this study show more or less similar to the result of other studies regarding single canal of mandibular first premolar tooth. But this study have shown more frequent type III canal configuration (27.5%) whereas other studies showed more number of type V canal than type III. The highest frequency of simple one canal (type I) was reported as 88.47% in an Iranian population and the lowest was 58.2% among in Jordanian[3]. The frequency of simple one-canal pattern in this study lied close to a Jordanian population(58.2%),[3] Turkish (60.5%)[4] and a SriLankan population (64.2%).[5] The highest frequency of class V (1-2 pattern) was reported in a Sri-Lankan population (28.4%)[5] compared to the current study (14%). Following table illustrates the distribution frequency of canal configuration in different studies

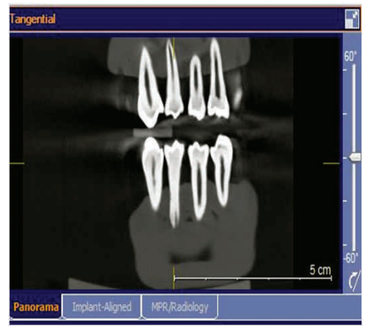

Figure 5- showing different canal patterns

The increased prevalence of anatomical variations documented in the present study makes it imperative for analyzing the possibilities of variations in root canal anatomy of mandibular premolars. These aberrations demand the need for proper diagnosis, treatment planning and careful execution of the treatment modality. Any failure of a root canal treated mandibular premolar demands the clinician to think about

Table 2- Canal configuration of mandibular first premolar according to Vertucci's classification in various populations.

Reference	Population								
		I	II	III	IV	V	VI	VII	VIII
Sert and Bayirli[4]	Turkey	60.5	18.5	10.5	7	2.5	0	0	1
Vertucci[2]	USA	70	0	4	1.5	24	0	0	0.5
Peiris[5]	Sri Lanka	64.2	0	2.5	1.2	28.4	0	0	0
	Japan	82.6	1.1	1.1	0	15.2	0	0	0
Velmurugan and Sandhya[7]	India	72	6	3	10	8	0	0	0
Awawdeh and Al-Qudah[3]	Jordan	58.2	4.8	1.4	14.4	16.8	0.8	1.0	0
Khidmat et al.[6]	Iran	88.47	1.84	3.22	0.9	4.14	0	0	0
Jain and Bahuguna[8]	India	67.39	7.97	3.62	2.89	17.39	0.72	0	0
Present study	Kerala	57.5	0	27.5	0	15	0	0	0

these variations, so that the tooth can be salvaged.

CONCLUSION

Observations of the current study confirmed the presence of ethnic differences among various races and provided some information about the internal anatomy of the mandibular first premolar in Kerala population. Further studies are recommended for other teeth to develop a comprehensive picture for dentition in Kerala population. One notable finding is as the length of tooth increases there is more chances for variation in canal pattern. This study also confirms that CBCT has potential as an auxiliary tool in the evaluation of mandibular premolars with complex canal morphology to improve the quality of root canal therapy. CBCT scanning is of great value in detecting anomalous canal morphology when diagnosis by conventional radiography is inconclusive.

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CASE REPORT

Indirect sinus lift – an approach for placement of implants in deficient maxillary ridges: A case report

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ABSTRACT:

The maxillary posterior edentulous region presents many challenges for an implantologist as deficient alveolar ridges can jeopardize the placement of implants in posterior maxilla due to the presence of maxillary sinus. The

present report describes the case of a 35 year old man with a missing 26 and deficient maxillary ridge. An indirect sinus lift was done and bone graft was placed followed by implant placement in the same site.Osteotomeswere used to prevent perforation of sinus lining during implant placement ensuring a successful restoration.

KEYWORDS: Deficient maxilla,sinus lift, bone graft

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INTRODUCTION

Implant dentistry has become an excellenttreatment modality since its inception into the modern era of dentistry. [1] The posterior maxilla is one of the most challenging sites to place as implant as far as an implantologist is concerned due to its various anatomical landmarks. Ridge resorption and sinus pneumatization are of primary concern.[2]Various techniques like sinus lifting procedure enables the additional anchorage and stability in implants placed support in maxillary segments in with atropic ridges and pneumatic sinuses.[3]

CASE REPORT

A 47 year old male patient in good health reported with the chief complaint of difficulty in chewing because of missing teeth in left upper back jaw region. On intra oral examination, left first molar was missing (Figure 1). After complete radiographic examination, it was observed that the height of the bone available for the implant in relation to first molar was 7.5 mm. After thorough examination it was decided to lift up the sinus lining with an indirect approach through alveolar crest using osteotomes and simultaneously place implants of 11 mm length and 4.2 mm diameter and

restore them. Pre-operatively, patient was subjected to a detailed clinical and radiographic examination of the soft and hard tissue.A written consent was obtained from the patient. Available bone height was recorded on using CBCT. On the day of surgery patient was prepared and was appropriately anaesthetized with local anesthesia. A mid crestalincision was made and a full thickness flap was reflected (figure 2). The implant osteotomy sites were then prepared upto7mm(figure 3). The sinus floor was carefully elevated using sequential osteotomes and a mallet with controlled force (Figure 4). The sinus floor was fractured with repeated osteotome insertion bone graft was placed. (Novabone putty)[figure 5]. The implant was then tapped gently into the prepared site. This procedure pushed the bone graftmaterial upward, leading to lifting of the sinus membrane2 mm ahead of the implant (Figure 6). The primary stability of theimplant was checked. The cover screw was then placed (figure 7), and sutures were given (figure 8).An IOPARof the site was taken post operatively .(Figure 9).

DISCUSSION

Implant treatment in the posterior maxilla was reported as the least predictable region for implant survival due to inadequate bone height, poor bone density, presence of maxillary sinus. However with the advancement in the field of dentistry implant supported prosthesis is no longer a challenge. Maxillary sinus floor elevation was initially described by Tatum in 1970 [4] and subsequently published by Boyne and James in 1980. [5] In 1994 Summers introduced the sinus lift technique with the use of osteotomes combined with graft material around the implant.[6] This technique is a well-validated surgical option for situations with limited residual bone height ≥ 5-6 mm[7,8] According to the relative literature, the osteotome technique appears to be a predictable and safe method for augmenting bone at the sinus floor and improving bone density and quality of the implant site sufficiently so that early loading is possible.[9] The sinus lift can be achieved by two approaches: (1) Using direct approach and(2) using indirect approach. In direct approach, the sinus isapproached from lateral side using one step or two stepantrostomy whereas in indirect approach, sinus isapproached from crest of the alveolar ridge and an osteotomeis used.

The advantages of indirect approach is that it is less invasive, involves less surgical complications, shorter healing and waiting period, improves the density of the maxillary bone which helps to get good stability.[10] Sinus floor augmentation by indirect technique along with simultaneous implant placement can be an excellent method for restoring the partial edentulism.

CONCLUSION

Sinus lift techniques have made implant placement in deficient posterior maxillary ridges less of a challenge. The indirect/closed sinus lift using osteotomes is an effective and less complicated method for the placement of implants in moderately atrophied ridges of the posterior maxilla. Even in compromised cases, by good evaluation of both patient's desires and the available possibilities and by choosing the suitable technique, the likelihood of success increases greatly.

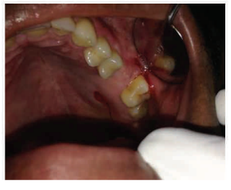

Figure 1: Pre operative view of implant site [26]

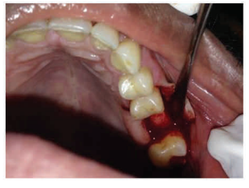

Figure 2: Full thickness flap reflected

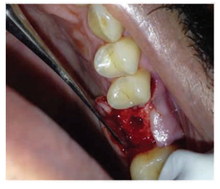

Figure 3: Osteotomy site prepared upto 8mm

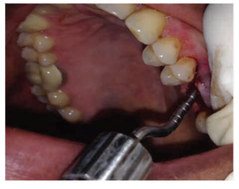

Figure 4: Osteotome used to break sinus floor

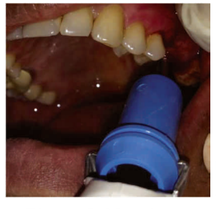

Figure 5: Novabone putty bone graft used

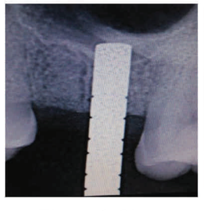

Figure 6: Sinus floor elevated

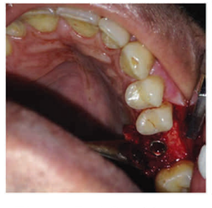

Figure 7: 4.2 x 11 mm implant placed

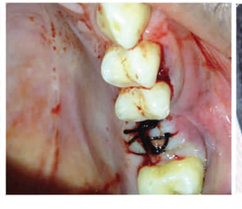

Figure 8: Sutures placed

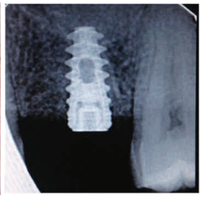

Figure 9: Post-operative IOPAR

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CASE REPORT

Platelet-Rich Fibrin–Reinforced Vestibular Incision Subperiosteal Tunnel Access (VISTA) Technique for multiple Root Coverage- A Case Report

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ABSTRACT:

Gingival recession (GR) can cause functional and esthetic problems with breakdown of both hard and soft tissues. It is clinically manifested by an apical displacement of the gingival tissues, leading to root surface exposure. Root hypersensitivity, erosion, root caries and esthetics can be of concern for patients with gingival recession. An array of therapeutic options are available for the management of GR by pedicle flap procedures or by free soft tissue graft procedures. But these technique sensitive procedures have led to an unpredictable healing outcomes. To overcome the post operative discomfort of the patient and complications, this new techniques have been recently suggested for the surgical treatment of both isolated or multiple recession type defects for better healing and patient compliance. Of late, vestibular incision subperiosteal tunnel access (VISTA) technique had shown a success rate of 85-90%. This case report describes the use of VISTA technique in combination with platelet rich fibrin (PRF), an autologous membrane to provide better healing and coverage of GR defects.

Keywords : Gingival recession, platelet-rich-fibrin, root coverage

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Conflict of Interest: None declared

Source of Support: Nil

INTRODUCTION

Gingival recession (GR) is the apical migration of the gingival margin beyond the cemento-enamel junction.[1] It can lead to major functional and esthetic problems and is clinically related to a higher incidence of hypersensitivity, attachment loss, root caries, difficulty in oral hygiene control and esthetic concerns. Gingival recession is caused by various anatomic modifications such as root anomalies, pathologic conditions such as periodontal disease, physiological and iatrogenic factors. It can be limited to one tooth or multiple teeth.

Recession can be treated through many surgical techniques but each technique has its own advantages and disadvantages. To enhance the growth,

Platelet-rich fibrin (PRF), a second-generation platelet concentrate, is obtained from autologous blood with simplified processing without the need for biochemical blood handling.[2]. It has become a focus of studies because of its potential to accelerate healing by releasing the growth factors into the defect area.[3]

Connective Tissue Graft (CTG) is considered as gold standard for root coverage. Numerous studies have illustrated various tunnel approaches with CTGs or allografts that maintain papillary integrity and avoid vertical-releasing incisions.[4,5] The common tunnel preparation techniques creates either a sub- or supra-periosteal space to extend beyond the mucogingival junction, allowing graft tissue to be inserted under the gingival collar by primarily using an intrasulcular approach. Technically challenging nature of intrasulcular tunneling and the increased risk of traumatizing and perforating the sulcular tissues are some of the limitations of these techniques especially in the esthetic region. As a consequence of these limitations, the Vestibular Incision Subperiosteal Tunnel Access (VISTA) approach was developed in order to avoid the potential complications of intrasulcular tunneling technique.[6] In this case report, we used novel and minimally invasive VISTA technique in combination with PRF in the treatment of multiple gingival recession defects.

CASE REPORT

A 35-year old patient came to our Department of Periodontology, Meenakshi Ammal Dental College with the chief complaint of sensitivity in relation to 23,24,25. On elaboration, patient did not present any medical history. Extra oral examination revealed no palpable lymph node, no facial asymmetry, no pain or clicking sound of TMJ. Intra oral examination revealed that the patient presented with Class I Miller's recession in relation to 23, 24, 25[Fig 1]. Since adequate width of attached gingiva was present, root coverage was planned with VISTA technique in relation to 23, 24, 25 along with PRF membrane.

At the initial visit, patient underwent Phase 1 therapy and instructed strict oral hygiene maintenance. To rule out any underlying systemic conditions, patient underwent blood investigation before surgical procedure. Patient was informed about the surgery and patient's consent was taken.

Surgical Technique

On the day of surgery, patient was comfortably positioned on the dental chair. Following the aseptic conditions in the operation area, patient was infiltered 1.5 ml of 2% lignocaine hydrochloride with 1:200,000 adrenaline. A vestibular access incision was given mesial to 23 [Fig 2]. The flat end periosteal elevator was introduced through the vestibular access incision and inserted between the periosteum and bone to elevate the periosteum, creating the subperiosteal tunnel [Fig 3]. The incision was extended one or two teeth beyond the teeth requiring root coverage and beyond mucogingival junction to mobilize gingival margin and allow coronal repositioning.

Preparation Of PRF

The PRF was procured according to Choukroun et al.[7] 10 ml of venous blood was drawn from the patient by venipuncture of the antecubital vein, prior to surgery. The blood was then transferred to 10 ml test tube without any anticoagulant and centrifuged immediately at 3000 rpm for 10 min using a tabletop centrifuge (REMI^{R}).

Separation of three basic layers was obtained after centrifugation: platelet-poor plasma at the topmost layer, PRF clot in the middle and red blood cells at the bottom layer. The middle layer PRF clot was removed from the other two layers and placed in a sterile dappen dish. The PRF clot was compressed between two cotton gauze pieces and PRF membrane was obtained[Fig4].

PRF was then trimmed according to the required dimension of the recipient site and extended 3-4 mm beyond the area to be covered. Through the vestibular access incision PRF membrane was tucked into the subperiosteal tunnel[Fig 5]. Orthodontic buttons were placed on the middle coronal third of each tooth and cured with flowable composite [Fig 6]. The membrane and the mucogingival complex was coronally advanced and sutured at the new position and orthodontic buttons using mersilk [Fig 7]. Periodontal dressing was placed on the surgical site. The patient was instructed to rinse with a 0.2% chlorhexidine solution for 2 weeks and to take amoxicillin 500mg thrice daily for 5 days and analgesic (Paracetamol 500mg +Aceclofenac 100 mg) twice daily for three days. The patient was instructed to be cautious while mastication and to avoid tooth brushing at the surgical site for 14 days.

Post-Operative Healing

Patient was recalled after 10 days and sutures were removed [Fig 8]. Wound healing was uneventful.

DISCUSSION

The novel and minimally invasive VISTA approach presented in this case report, along with PRF provides a number of unique advantages to the successful treatment of multiple recession defects. In VISTA technique, an access to an entire region is obtained through a single vestibular incision, including visual access to the underlying alveolar bone and root dehiscences. Tension of the gingival margin is reduced through careful subperiosteal dissection during coronal advancement of the flap. By avoiding papillary reflection, anatomical integrity of

the interdental papillae is maintained.

A vertically oriented initial incision is less likely to disrupt the blood supply as superior alveolar arteries, branches of the internal maxillary artery, run in a superior-inferior orientation.[6] Degree of coronal advancement of the gingival margin advocated during the procedure is one of the important technical difference between the VISTA and other tunneling approaches. As noted earlier, the gingival margin, with PRF membrane, is advanced coronally to the level of the adjacent interproximal papillae rather than to the cementoenamel junction. Apical relapse of the gingival margin during the initial stages of healing are prevented by securing polypropylene sutures(3-0) to the facial aspect of the tooth.

One of the major drawbacks of regenerative healing is micromotion, which promotes scar tissue formation. The rigid fixation of gingival margins due to the present coronally anchored suturing technique minimizes micromotion of the regenerative site. Therefore, the major advantage of the present technique over conventional methods is the reduction of micromotion where there is proper adaptation of the gingival margin.

PRF is a second generation of platelet concentrate. It is superior to PRP as the processing is simplified without any complex handling. PRF is mainly used in root coverage procedures as it promotes wound healing, bone regeneration, graft stabilization, wound sealing, and hemostasis. It is efficient to direct stem cell migration and healing program as the fibrin matrix is better organized.[7]

In our study 90% of root coverage was obtained which was in accordance with Aroca et al where mean root coverage was 91.5% in coronally advanced flap combined with PRF.[8] Zadeh et al used VISTA technique along with Bio guide membrane for root coverage of maxillary anterior teeth for treatment of Miller's Class I and II defects and demonstrated stable, long-term outcomes.[6] A study by Chatterjee et al reported two clinical cases with Miller's Class I and Class II multiple recession defects treated successfully by VISTA technique with PRF membrane achieving 96% of root coverage thereby concluding that multiple recession defects can be treated with VISTA technique without the need for secondary harvesting procedure.[9]

CONCLUSION

An array of treatment choices exist for the treatment of localised gingival recession; however for multiple defects major functional and esthetic problems exist. Inherent short-comings of some of the current procedures are addressed in multiple recession defects. The present VISTA technique potentially speaks to these short-comings. To conclude VISTA technique can be used successfully in multiple gingival recessions treatment as an alternative to some of the limitations of the current techniques. Long term follow- up as well as further clinical data are required to provide evidence regarding the predictability of this treatment outcome in multiple recession defects.

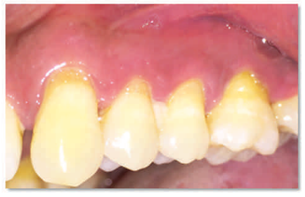

Fig 1: Pre- operative: Recession i.r.t 23, 24, 25

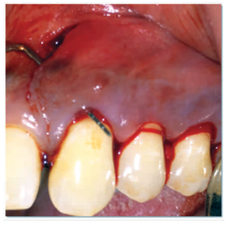

Fig 2: Vestibular incision done mesial to 23

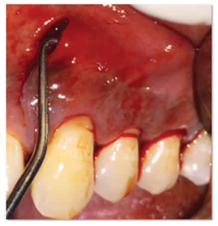

Fig 3: Sub- periosteal tunnel prepared

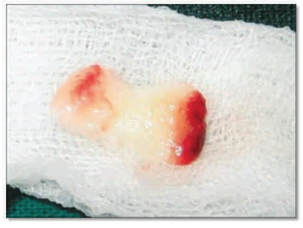

Fig 4: PRF membrane

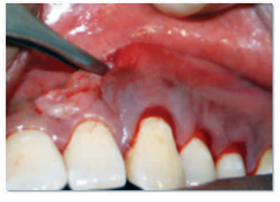

Fig 5: PRF tucked into the tunnel created

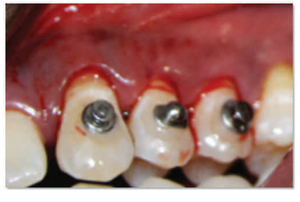

Fig 6: Orthodontic buttons placed on the middle coronal third of the crown

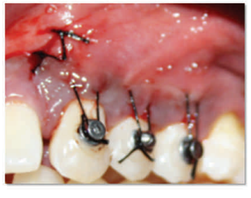

Fig 7: Coronally anchored through orthodontic buttons

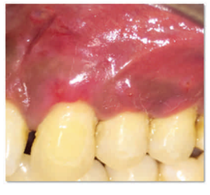

Fig 8: Post-operative after 10 days

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CASE REPORT

Surgical management of a periimplant abscess: A case report

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ABSTRACT:

This case report discuss a case of periimplant abscess, surgically managed by bone regenerative approach. A 22 year old male patient reported with a complaint of fluctuating swelling that subside and recur over the edentulous ridge area. The radiograph of that region confirmed it to be a peri implant abscess around the crestal third of an immediate implant placed an year back.The lesion was surgically approached and the defect was filled with bone graft material (Osseograft ™) and secured with a connective tissue graft over it to secure graft material. The third month follow-up showed no clinical signs or symptoms of the previous lesion and significant bone regeneration was observed radiographically in the bone defect.

Key words : Bone Regeneration, Periimplant abscess , immediate implants

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Date of acceptance: 22-08-2016

INTRODUCTION

A 22 year old systemically healthy male patient was referred to our department of clinical periodontology and oral implantology, with a fluctuant swelling on the maxillary right posterior edentulous ridge area. He revealed a history of 2 immediate implants being placed in this region 1 year ago. The swelling was noticed since 6 months which was painless and kept occurring intermittently and disappeared following purulent discharge through a sinus opening. The immediate implants were placed following extraction of root stumps of 15 and 16 resulting from endodontic treatment failure. According to his old radiograph, all the extracted teeth had peri apical radiolucency confirmed to be peri apical granuloma at the time of extractions.

On clinical examination, swelling was about 6×6mm in size with a sinus opening (Figure: 1).

On radiographic examination with placement of a gutta perchapoint into the sinus opening, vertical bone loss was noticed around the coronal 1/3 rd of implant with the gutta percha pointing towards the depth of bone defect adjacent to one of the implants (Figure: 2).

MANAGEMENT

A surgical treatment with an objective of abscess elimination and bone regeneration around the lesion was planned. A written consent was obtained from the patient prior to the surgery explaining about the procedure and possible chance of recurrence of the lesion. The fluctuant swelling was massaged gently and purulent discharge was drained completely through the sinus opening and the patient was recalled after a week the surgical management.

Antisepsis of surgical area was carried out through aqueous solution of 0.12% chlorhexidine digluconate. After local anesthesia with lignocaine solution, the implant site was approached with a semilunar incision along the outer margins of the swelling. A full thickness mucoperiosteal flap was elevated over the implant surface involving the swelling. The implant was confirmed for its integration and observed to have no signs of mobility.

The granulation tissue around the implants was curetted with plastic curettes. The granulation tissue that was projecting from the flap into the lesion was excised. After the debridement, circumferential vertical bone resorption was noticed around the margins of the implant placed on the site of extracted 16 as seen in Figure 3. The area is then rinsed and cleaned with normal sterile saline irrigation.

The periimplant vertical bone defect around the crestal 3rd of implant was grafted with bone graft material (OSSEOGRAFT ™) known to posses good potential of osseous regeneration. The graft material was applied after mixing it with a few drops of sterile normal saline solution to make it into a paste like consistency appropriate for bone void filling (Figure:4).

One of the main limitations of such surgery is graft stability and eventually its loss owing to its position of lesion adjacent to implant wall and also exposure of cover screw following healing. The connective tissue of the raised flap was separated from the flap and was pediculated and sutured over the bone graft material into the surrounding periosteum to secure the graft material in position. The raised flaps were approximated back and sutured with 3-0 non resorbable multiple simple interrupted sutures. The knots were placed buccally to avoid any disturbance by tongue during healing that would result in membrane exposure (Figure. 5 - 7).

The patient was instructed to rinse with an appropriate antimicrobial agent twice daily for 2 weeks. Antibiotics (Amoxicillin 500 mg) and a non steroidal anti-inflammatory drug (Paracetamol 500mg) were given post operatively for 5 days. The healing took place uneventfully and the sutures were removed on the 10th day after the surgery.

The patient was recalled after 3 months for review. There was no evidence of clinical signs or symptoms of swelling or sinus tract in the operated site (Figure.8). The area appeared

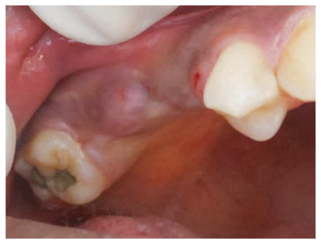

Figure 1. Pretreatment photograph of periimplant abscess

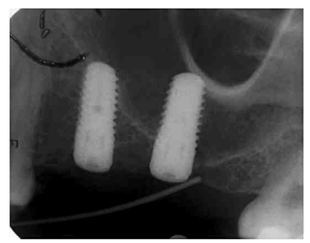

Figure 2. Periapical radiograph showing gutta percha point directed to the posterior implant margin with vertical bone loss

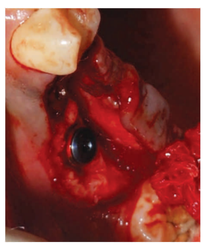

Figure 3. The circumferential bone loss around implant evident after debridement.

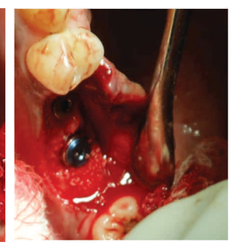

Figure 4. The vertical bone defects grafted with OSSEOGRAFT ™ (DMBM) bone graft material.

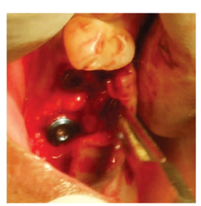

Figure 5. Connective tissue graft obtaining from the full thickness flap .

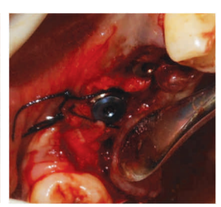

Figure 6. The connective tissue graft is sutured as a collar over the bone graft material.

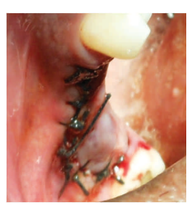

Figure 7. Flap is repositioned with simple interrupted sutures.

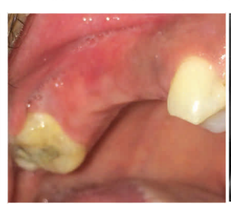

Figure 8. 3 months follow-up photograph with cliinically normal operated site.

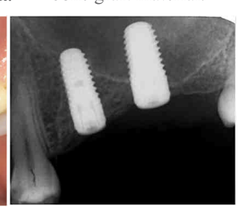

Figure 9. Periapical radiograph showing regeneration of bone around the treated implant.

clinically normal. On radiographic examination, there was clear evidence of complete bone fill in the defect area around the implant (Figure .9).

CONCLUSION

The present case described a variant technique of guided bone regeneration to manage periimplant abscess. This procedure could achieve complete restoration of perimplant mucosa with radiographically evident complete bone regeneration in a 3 month review. There are several studies which support the present case report wherein periimplant bone loss is successfully treated by different regenerative approaches with the use of bone graft materials.[1,2,3] The quality of the bone which is regenerated in the present case report is not evaluated by histological studies or by reentry surgeries. The long term success rate of such treatment can only be evaluated by regular follow ups and maintenance.

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CASE REPORT

Peripheral Cementifying Fibroma: A Case Report

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ABSTRACT:

Peripheral cementifying fibroma is one of the inflammatory reactive hyperplasia of gingiva rather than neoplastic in nature. There are numerous histologically different types of focal overgrowths which may occur in gingiva. A clinical case report of 15 years old male patient with gingival overgrowth suggesting gradually increase in size of lesion, involving buccal interdental papilla and attached gingiva in relation to upper left and right central incisor which is pink in color and firm in consistency is presented. Histological reports suggested presences of cementicles along with large number of inflammatory cells.

Key words: Gingival overgrowth, ossifying fibroma, cementicles.

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INTRODUCTION

Peripheral cementifying fibroma is a non neoplastic entity, which occurs on the gingiva in response to trauma or irritation, plaque, calculus, restorations and dental appliances.[1] Considerable confusion has prevailed in the nomenclature of peripheral ossifying fibroma with various synonyms being used, such as peripheral cementifying fibroma, ossifying fibroepithelial polyp, peripheral fibroma with osteogenesis, peripheral fibroma with cementogenesis, peripheral fibroma with calcification, calcifying or ossifying fibrous epulis and calcifying fibroblastic granuloma.[2] It occurs in the younger age group with a female preponderance with a predilection for maxillary arch. Most of them occur in the incisor cuspid region. It is usually present as a painless mass on gingiva or alveolar mucosa with measurements not exceeding 3cm. It can be either be pedunculated or sessile with its attachment to base. Clinically earlier lesions appear irregular and red and older lesions have a smooth pink surface with ulceration.[3]

CASE REPORT

A 15 years old male patient reported to the department of periodontology with a chief complaint of growth of gums in upper front teeth since one month.

Patient had no systemic illness and was not on any medication.The lesion had gradually increased in size during previous few days.

On intra oral examination a solitary, pedunculated mass involving buccal interdental papilla and attached gingiva in relation to upper left and right central incisor was seen(figure 1). Intra oral periapical radiograph showed no significant bone loss(figure 2). Mass was pink in color with a smooth surface, measuring approximately 1.5 cm × 2 cm and extending from mesial interdental papilla of right central incisor to distal surface of left central incisor. No surface ulceration was noted. On palpation, it was non tender and firm in consistency.

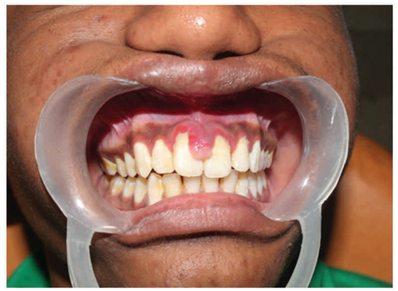

Figure 1: Intra oral picture showing gingival mass with relation to upper central incisors. Before phase I therapy.

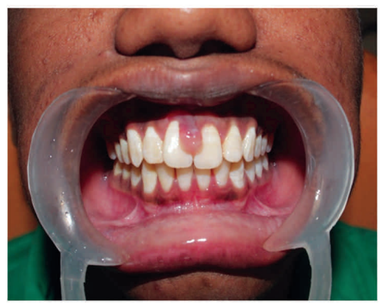

Figure 3 : 1week follow up post phase I.

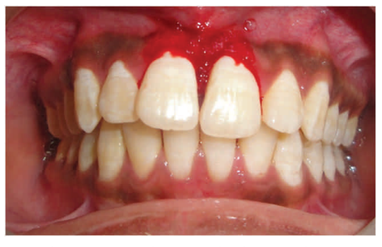

Figure 4: During surgical procedure : incision and gingival curettage

The provisional diagnosis of peripheral ossifying fibroma was made. The differential diagnosis included traumatic fibroma, pyogenic granuloma and peripheral giant cell granuloma.

Treatment included thorough scaling and root planning to eliminate the irritating factors (figure 3). After a week, complete surgical excision of the lesion was performed under local anesthesia. Complete removal of the lesion and gingival curettage was ensured(figure 4). Application of periodontal dressing (coe-pack) (figure 5) and Oral hygiene maintenance instructions were given to the patient. Healing was uneventful. Patient was recalled after 7 days (figure 6) and follow up visit after 3 months respectively (figure 7).

HISTOLOGIC EXAMINATION

The sample was sent to oral pathology department at faculty of dental science, dharamsinh desai university, nadiad for laboratory investigation. On histopathological examination, upon low power magnification (4x)(figure 8), the tissue exhibited a hyperkeratinized stratified squamous epithelium (gingiva), overlying a fibrous connective tissue stroma exhibiting dense interlacing mature bundles of collagen(figure 9). High power magnification (40x) showed presence of cemeticles(figure 10). Large number of acute and chronic inflammatory cells, dilated engorged blood vessels and areas of hemorrhage were seen. The picture is consistent with the clinical diagnosis of peripheral cementifying fibroma.

DISCUSSION

Gingiva is one of those anatomical regions in the oral cavity

Figure 2 : Radiographic view showing no significant bone loss.

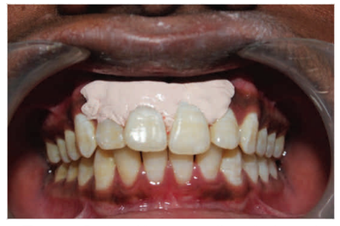

Figure 5: Application of periodontal dressing(coe pack).

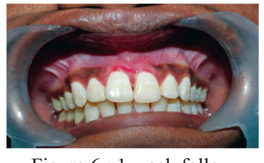

Figure 6 : 1 week follow up post surgery

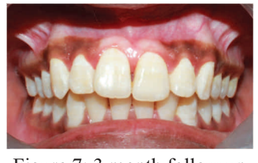

Figure 7: 3 month follow up post surgery

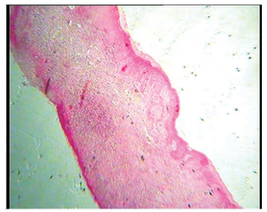

Figure 8: Histopathological examination of the lesional tissue at ×4 magnification

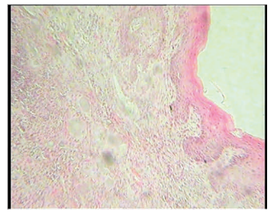

Figure 9: Photomicrograph showing fibro-cellular stroma with surface epithelium, (H and E, ×10)

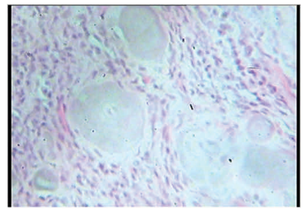

Figure 10 : Histopathological examination of the lesional tissue at ×40 magnification showing fibroblast and cementicles .

with the broadest array of lesions occurring ranging from inflammatory to neoplastic. Peripheral cementifying fibroma(PCF) is one such reactive lesion, which occurs exclusively on gingiva. It accounts for 9.6% of gingival lesions.The more common terminology used for peripheral cemetifying fibroma is peripheral ossifying fibroma. Both represent same state of clinical picture and in histology difference in predominent cell type is noted.

Histogenesis remains controversial and there are two schools of thought proposed to understand the histogenesis of PCF.

· PCF may initially develop as pyogenic granuloma that undergoes subsequent fibrous maturation and calcification. It represents the progressive stage of the same spectrum of pathosis.[4]

· PCF is due to inflammatory hyperplasia of cells of periodontal ligament/periosteum. Metaplasia of the connective tissue leads to dystrophic calcification and bone formation.[5]

Triggering factors such as subgingival plaque and calculus, dental appliances, poor quality of dental restorations, micro organisms and food lodgement initiate the inflammatory response.[6]Only 0.5% cases are reported in older age group.[1] There is a female predilection for the lesion due to the hormonal influences.[8] PCF is usually seen anterior to molars, especially in incisor canine region.[9]

POF has to be **differentiated** from other reactive lesions of a gingiva such as pyogenic granuloma, peripheral giant cell granuloma (PGCG) and peripheral odontogenic fibroma. Pyogenic granuloma shows red mass with surface ulceration clinically and microscopically exhibit vascular proliferation resembling granulation tissue. PGCG shows scattered giant cells in a fibrous stroma. Peripheral odontogenic fibroma contains prominent islands of odontogenic epithelium.[5] Bone involvement, though not significant in most of the cases, some alterations are noted like superficial erosion of bone, foci of calcifications, widening of the periodontal ligament space and thickened lamina dura,[5] migration of teeth with interdental bone loss.[2]

Treatment of peripheral cementifying fibroma requires proper surgical intervention that ensures deep excision of the lesion including periosteum and affected periodontal ligament. Thorough root scaling of adjacent teeth and/or removal of other sources of irritants should be accomplished. In children, reactive gingival lesions can exhibit an exuberant growth rate and reach significant size in a relatively short period of time. In addition, the POF can cause erosion of bone, can displace teeth, and can interfere or delay eruption of teeth. Early recognition and definitive surgical intervention result in less risk of tooth and bone loss.[10] The recurrence rate varies from 7 to 20% according to different authors. [11]

CONCLUSION

PCF is a pathological entity whose histogenesis is yet to be delineated. Clinico pathological characteristics may vary and on the contrary to the usual presentation, our case presented a different age, sex and site of PCF. Treatment consists of surgical excision, including through scaling and root planning. Close postoperative followup os required because of growth potential of incompletely removed lesion and the 8%-20% recurrence rate.

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CASE REPORT

Oral soft tissue chondroma: A case report with discussion

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ABSTRACT:

Chondromas are benign tumours of hyaline cartilage that are usually found in the bones of the extremities. Extra-skeletal chondromas have been rarely reported in the soft tissues of the head and neck region. Among them, only very few cases have been reported in the oral cavity.The present case documents a soft tissue chondroma in a 25 year old female patient that presented as a swelling on the tongue. The importance of histopathologic examination which leads to a conclusive diagnosis and a review of the relevant literature is also included.

KEYWORDS: Chondroma, soft tissue chondroma, tongue, oral.

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Conflict of Interest: None declared Source of Support: Nil

INTRODUCTION:

Chondromas are benign tumours of hyaline cartilage, that are usually found in the bones of the extremities. Soft tissue chondromas are extra-skeletal tumors and are not attached to bone, synovium or periosteum. They commonly occur in the soft tissues of hands and feet.[1,2] A few cases have been reported in the oral cavity.The common intraoral sites reported are the tongue, buccal mucosa, hard and soft palate and the edentulous ridge.[3] The tumour mainly affects adults 30-60 years of age and is rare in children. [4, 5] They usually have a benign clinical course and appear as asymptomatic, slow growing and well defined nodular lesions.[6,7] Though it is usually diagnosed by its histopathologic features, it can sometimes be confused and needs to be differentiated from chondrosarcoma, a malignant tumour of the cartilage. A thorough histopathologic evaluation for rendering an accurate diagnosis is necessary to spare the patient from unnecessary radical treatment, which may arise from anerroneous diagnosis. A case of extra-skeletal chondroma of the tongue, along with a review of related literatureis presented here.

CASE REPORT:

A 25 year old female patient was referred to the Department of Oral and

Maxillofacial Surgery complaining of a painless swelling on the under-surface of the tongue. She first noticed the swelling one and a half years back. It grew very slowly to reach the present size. Intra oral examination revealed an ovoid nodular mass measuring 1x1x1 cm, on the ventral surface of the tongue on the anterior part. On palpation, it was found to be firm, painless and non-fluctuant (Figure.1). Considering a differential diagnosis of traumatic fibroma, neurofibroma or Schwannoma, which were the most common nodular swellings to occur on the tongue, an excisional biopsy of the lesion was performed under local anaesthesia.

The excised specimen appeared as a creamy white mass, measuring 1cm in diameter and was firm to hard in consistency. It was processed and submitted for histopathological evaluation.

Microscopic examination revealed lobules of mature benign hyaline cartilage in a fibrous connective tissue stroma (Figure. 2). The cartilage consisted of bland appearing chondrocytes within lacunae (Figure 3).There was no evidence of cytological atypia, mitosis or necrosis. Superficial stratified squamous epithelium was also observed.

Based on these findings, a diagnosis of 'Soft Tissue Chondroma of the tongue' was made.

DISCUSSION:

Chondromas are benign tumors arising from cartilaginous tissue. They occur within various bones of the body. The incidence of soft tissue chondromas outside the skeletal system is very rare. They usually occur in the soft tissues of the extremities.[1,2] Soft tissue chondromas of the oral cavity are rare, only 47 cases have been reported in the English literature. Tongue is the most commonly reported site for intra-oralsoft tissue chondromas, followed by buccal mucosa, hard palate, gingiva, soft palate and lip.[3] Oral soft tissue chondromas are seen to occur more commonly in the third and fourth decades of life.[4,5] These benign neoplasms usually present as non-symptomatic, slow growing and well defined nodular masses expanding into the surrounding soft tissues. [6,7] The diagnosis of a soft tissue chondroma is usually made by observing the histopathologic features.

Microscopically, they are similar to skeletal chondromas, composed of lobules of mature, adult hyaline cartilage, with chondrocyte cells often growing in clusters. The chondrocytes are typically monotonous in appearance, with no pleomorphism or mitosis. One third of the cases may show extensive calcifications, particularly in the centre of tumour lobules. [6]

It is extremely important to differentiate this tumor histologically from chondrosarcoma, which is a malignant neoplasm of the cartilage. Well differentiated extra skeletal chondrosarcoma will show abnormal mitoses, atypism and necrosis. Mesenchymal chondrosarcoma is another chondroid malignancy with a characteristic dimorphic pattern composed of well differentiated cartilage surrounded by small undifferentiated tumor cells. [8] Our case showed the typical histopathologic features of chondroma with the chondrocytes exhibiting no cellular atypia or abnormal mitosis.

Different theories have been proposed as to the origin and occurrence of Chondromain the oral soft tissues. '*The embryonic remnants theory*' suggests that heterotopic cartilage remnants from the bronchial arches get displaced during the development and get sequestered in the tongue or other oral soft tissues. [9,10] This probably accounted for the increased incidence of soft tissue chondromas reported in the tongue. '*The Metaplastic theory'* explains the chondromas located on the lateral border, ventral surface or tip of the tongue, especially in an older age group. It suggests that factors like trauma or chronic irritation can stimulate metaplasia and subsequent development of tumours.[11,12]The high incidence of the recently described 'ecto mesenchymal Chondro myxoid tumours' of the tongue may be explained by a possible pathogenic mechanism involving the para-physiologic cartilaginous tissue of the lingual septum (referred to as'knorpelinsel'). This theory may also be used to explain the occurrence of chondrosarcomas of the tongue. [13, 14]

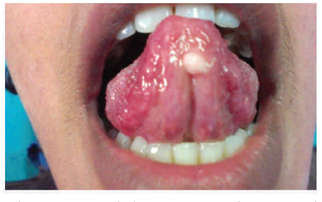

Figure 1: Nodular mass on the ventral surface of the tongue.

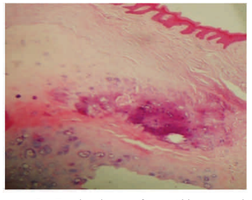

Figure 2: Lobules of cartilage within the fibrous connective tissue stroma, H & E stain, 10x.

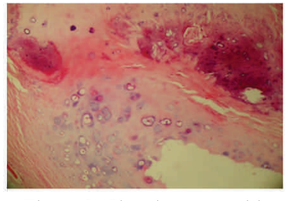

Figure 3: Chondrocytes with no features of atypia or mitosis, H & E stain, 40x.

CONCLUSION:

Our case report presents the occurrence of a rare tumour of the tongue –the soft tissue chondorma. Clinically they may resemble other common lesions to occur on the tongue – neural tumors, traumatic fibromas etc. A thorough histopathologic evaluation will lead to a conclusive diagnosis, and also help in differentiating it from the malignant chondrosarcoma. This is extremely important to spare the patient from unnecessary radical treatment.

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CASE REPORT

Single Rooted Permanent Maxillary Molars with Vertucci's Type I canal configuration: 3 Rare Case Reports

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ABSTRACT:

Unusual root canal morphology in maxillary molars is constant challenge for diagnosis and successful endodontic treatment. Presence of additional canals, lateral canals and deltas are mostly encountered but the probability of existence of less number of roots and canals also occurs. These deviations are also one of the major grounds for endodontic treatment failure owing to inadequate cleaning, shaping and sealing of root canal system. The present paper highlights two case report about maxillary molars with type I canal morphology. It is concluded that the diagnosing of these unusual cases is of high importance for successful endodontic treatment of these teeth. Dentists are required to have adequate knowledge related to root canal morphology and their possible variations.

Keywords: Permanent Maxillary Molars, Maxillary First Molar, Maxillary Second Molar, Single Root, Single Canal Morphology

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INTRODUCTION

The diversity and complexity of root canal anatomy are constant challenge for diagnosis and successful endodontic therapy, particularly in multi-rooted teeth. Thus, it is indispensable for the clinician to have a thorough knowledge of root canal anatomy and its variations.[1] Anatomic variations in permanent maxillary molars have been reported earlier and they pertain to the incidence of supplementary canals, roots or fused roots[2,3] and "C"- shaped canal.[4]Single rooted maxillary molar is unusual, and even scarcer in case of maxillary first permanent molar. [5]

The foremost objectives of root canal treatment are thorough cleaning and shaping of all the canals. Dentists must be able to envision the internal anatomy of teeth before undertaking endodontic therapy. Endodontic success can be achieved together with diagnosis, treatment and knowledge of root canal morphology and its recurrent variations. (Burns &Herbranson, 2002)[6]

Fava et al.reported a single root and a single canal on the maxillary and mandibular second molar. This feature is more often on lower mandibular molars, but it can also appear on maxillary molars, other molars and premolars. Therefore, the majority of studies related to variations of maxillary molars are related to first molar since variations of maxillary second molar are rare.[7]

Hence in this paper we are discussing about three case reports that have type 1 canal morphology in permanent maxillary 1st molar and second molar

CASE REPORT 1

A 17-year-old Indian female presented to the Department of Conservative Dentistry and Endodontics, K.V.G Dental College and Hospital, Karnataka, India with the chief complaint of dull toothache in her left posterior maxilla for 20 days. On thermal stimuli and on mastication the pain was intensified. Medical history of the patient was noncontributory. On clinical examination, there was decay on left maxillary first molar which was tender on percussion. The tooth was not mobile and periodontal probing around the tooth was within physiological limits. Vitality testing of the involved tooth with heated gutta-percha, dry ice and electronic pulp stimulation caused no response suggestive of non-vital tooth. A preoperative radiograph revealed a coronal disto-occlusal radiolucency approaching the pulp space [Figure 1].

On the basis of clinical and radiographic findings, the patient was advised root canal treatment in relation to tooth # 26. After obtaining patient's consent, the tooth was anesthetized with 1.8 mL 2% lignocaine containing 1:200,000 epinephrine followed by rubber dam isolation. Access preparation was modified to completely de-roof the pulp chamber, which showed the presence of a single wide root canal orifice. Presence of only one single canal and no other canal orifice was revealed on examination under a surgical operating microscope. With the help of an apex locator which was later confirmed using a radiograph the working length was determined. Multiple working length radiographs were taken at different angulations.

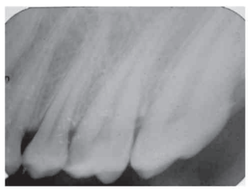
Cleaning and shaping was done using crown-down technique with ISO hand files and ProTaper nickel-titanium rotary instruments. Irrigation was performed using normal saline, 2.5% sodium hypochlorite solution, with 17% ethylenediamine tetracetic acid and chlorhexidine being used as the final irrigant. With absorbent points the canals were dried, and using cold lateral compaction of gutta-percha obturation was completed (figure2).

CASE REPORT 2

A 25-year-old male patient visited the Department of Conservative Dentistry and Endodontics, K.V.G Dental College and Hospital, Karnataka, India. His primary complaint was spontaneous pain on the left maxillary second molar (figure 3, 4). Clinical and radiographexamination revealed fractured occlusal amalgam restoration in relation to 26 and carious tooth irt 27.26 and 27 were sensitive in vertical percussion, coldness and warmness. On access opening of 26 and 27, only single canals were revealed (figure 5).

CASE REPORT 3

A 38-year-old male patient visited the Department of Conservative Dentistry and Endodontics, K.V.G Dental College and Hospital, Karnataka, India. On examination revealed carious tooth irt 27(figure 6). His primary complain, was food lodgment on the left maxillary second molar from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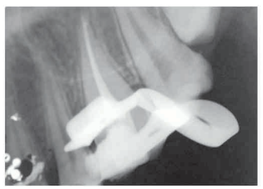
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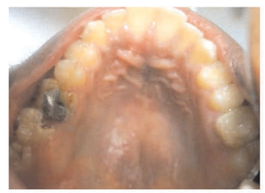
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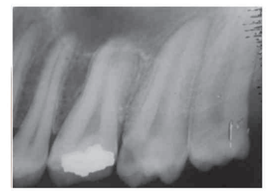
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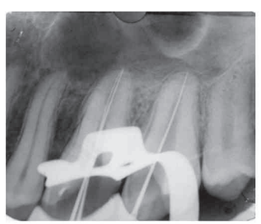
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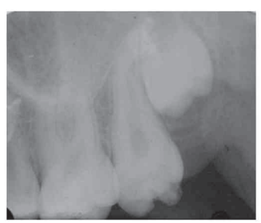
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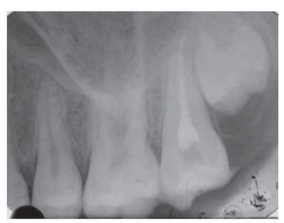
Figure 7

appeared more frequently during the night lasting 2 to 3 hours with brief calming periods. The tooth was sensitive in vertical percussion, coldness and warmness. On access opening of 27 only single canal was discovered. (Figure 7)

DISCUSSION

Dental abnormalities which are formative defects may occur during any of the developmental stages of the tooth, and they are revealed clinically in later life once the tooth is fully formed. [8]

Incidence of additional canal is more recurrent rather than the presence of fused/less number of canals, particularly in the cases of permanent maxillary first molars. Immense disproportion in the root/root canal morphology of permanent maxillary molars of Indian origin exists as compared with Caucasian and Mongoloid traits, as reported in a computed tomographic research. The dissimilarities reported in the population were the presence of single root and canal, two separate roots, four separate roots and two fused roots, three fused roots.[9]

There are few case reports that were found to have reported dental anomalies such as fused single rooted maxillary molar: Ackerman et al., [10]Holan and Chosack, [11] Gopikrishna et al., [12]Metgud et al. [13] There appears to be a difference in opinion regarding the term used to describe such a tooth, this includes "fused." "Pyramidal," and "conical" but all investigators believe that the failure of invagination of Hertwig epithelial root sheath is accountable for this anomaly.

Maxillary second molars with triple roots and triple canals compared to maxillary second molar that could have a single root and a single canalis more often described in endodontic literature [14]. Hartwell & Bellizi concluded that only 0.6% of cases there is presence of maxillary second molar with a single root and a single canal.[15]. Libfeld and Rotstein assessed 200 radiographies of patients treated in an endodontic therapy in maxillary second molar and reported that this feature was evident in 0.5% of cases.[16]According to Hua XI et al. the frequency of maxillary second molar with single root and single canal is very unusual.[17]

This paper highlights 3 different case reports where Vertucci's Type 1 canal configuration is seen in maxillary permanent molars. Since the incidence of single root and single canal is not high, it is important to confirm the canal configuration before finishing root canal treatment in order to ensure success. Presence of single canal in the 3 cases was evaluated through radiographic assessment and application of operative microscope and a loop. These teeth have good endodontic prognosis, because of wide and accessible canal.

CONCLUSION

Anatomical variation continues to be the most challenging aspect of performing successful endodontic therapy. Quitemore importance is given to extra canals, merging and demerging canals, apical deltas, and lateral canals but the clinician should also focus on the presence of fewer canals. The present case reports highlight the necessity to develop excellent observation skills on the part of the dentist to identify any aberrations from the normal within the tooth, especially in the presence of anomalies in dentition.

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Krishna, *et al.*:Molars with Vertucci's Type I canal configuration

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CASE REPORT

Langerhans cell histiocytosis in a 7 month old baby: A case report

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ABSTRACT:

Langerhans cell histiocytosis (LCH) is a rare and unusual disease of unknown etiopathogenesis which is characterised by the clonal proliferation of Langerhans cells (LC) that predominantly occurs in infants and young children. Besides the varied clinical picture, oral manifestations are sometimes the first and the only indication of this disease. Hence the odontologist plays a crucial role in early diagnosis and periodic follow- up to ensure multidisciplinary treatment of such patients. Generally in children, local therapy in the form of curettage would be an appropriate treatment, since patients with localised disease or disease limited to a single organ system have a good prognosis. However due to the high recurrence rate, site of presentation and late stage complications observed in early presentation cases, we describe a case of LCH observed in a child of seven months successfully treated with multi- agent chemotherapy with six month follow- up.

Keywords: Langerhans cell histiocytosis, eruption hematoma, chemotherapy

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Source of Support: Nil

INTRODUCTION

Langerhans cell histiocytosis is the current designation replacing the term histiocytosis X introduced by the Lichenstein in 1953 as a unifying designation for several previous eponyms, including Letterer Siwe disease, Hand Schuller Christian disease, and eosinophilic granuloma (LCH of bone).[1]

LCH is an infrequent disease with an occurrence rate of 2-5 cases per million inhabitants per year with frequency seen in first and third decades of life although it may affect any age group with predominance in males.[2,3,4]

Although clinical forms of LCH were first described at least a century ago, its pathogenesis remains obscure, with the one common denominator being the Langerhans cell, a bone marrow – derived, antigen- presenting dendritic cell. Langerhans cells reside in the skin, thymus and mucosal epithelium,

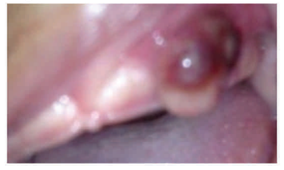
including the oropharynx and nasopharynx, esophagus, bronchi, and cervix and are said to be the most potent antigen presenting cells in the body.[5] Various hypotheses have been put forward regarding etiology such as dysfunction of immune system, deficiency of suppressor lymphocytes (T8), altered immunoglobulins, autoantibodies, anomalous lymphocytic response to various mitogens, structural changes in thymus, inflammatory origin, bacteriological origin. The systemic alterations result from the accumulation of Langerhans cell infiltrate that produces different clinical manifestations depending on the location.

The clinical manifestations of LCH range from solitary or multiple bone lesions with a chronic course to progressive disseminated visceral, skin and bone lesions. Alongside the cranium, the maxilla and the mandible are the most affected bones.Oral manifestations may be the first sign of LCH, and on some occasions the oral cavity may be the only area affected[6]. The incidence of oral lesions is 77%,[4] therefore the initial diagnosis in many cases is made by the odontologist. In a series of fifty patients with LCH, 36 per cent had oral involvement and the dentist was the first to see them in 16 per cent of the cases. [7]

CASE REPORT

A 7 month old baby boy reported to the dental clinic with a swelling in the upper left anterior region. History revealed that the patient had trauma with a plastic spoon while feeding one month back. On examination dark red swelling of size 1cm ×1.5cm×0.3cm was observed with no history of pain or associated symptoms. (Figure 1) On palpation displacement of 61 was detected. On radiographic examination displacement of 62 and 63 was observed (Figure 2)

Figure 1: Intraoral Examination



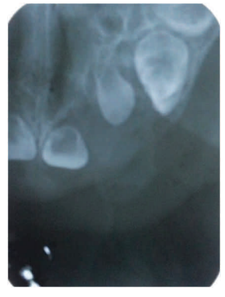


Figure 2: Intraoral Radiograph

Laboratory studies revealed a mild normocytic normochromic anemia (9.73 g/dL; reference range 12.2 to 18.1 g/dL).

Biopsy by conventional microscopy showed fragments of highly cellular neoplasm composed of monotonous cells arranged in diffuse sheets with close admixture of eosinophils. Cells were medium sized with oval to elongated nuclei with occasional nuclear grooves and folds. A few multinucleated giant cells were also seen admixed. Lesion was seen infiltrating the bony trabeculae. Immunohistochemistry revealed CD1a, S100 and CD68 showed strong positivity in the tumor cells which confirmed the diagnosis of LCH.

Upon diagnosis, the patient was administered standard induction therapy including vinblastine and prednisone for six weeks followed by repeat imaging. Interim imaging withat 6months revealed a positive response to therapy with no progression of disease.

DISCUSSION

The differential diagnosis of the oral lesion included eruption hematoma, gingival epulis of newborn and hemangioma. However on radiographic examination, mucosal lesion with displacement of upper anterior teeth raised suspicion towards a more aggressive lesion.

A presumptive diagnosis of LCH may be based upon light microscopic findings and a compatible clinical picture, but a definitive diagnosis, requires that lesional cells exhibit positive staining with S-100 and CD1a. In the present case report a confirmative diagnosis was made on the presence of both these markers. The gold standard however was the detection of Birbeck granules by electron microscopy which has become obsolete due to variations seen with tissues taken from different organ systems. Therefore, other pathognomic surface markers are being sought such as the novel monoclonal antibody Langerin which appears to be more sensitive and specific for LC than CD1a and in future may be a key diagnostic component of LCH.[8]

The prognosis of LCH is difficult to assess since this is a rare disease with high clinical variability. In the majority of patients LCH is a self – limiting process, although often with alternating phases of relapse and remission. The most important factors that may worsen the prognosis are visceral involvement (liver, lung, bone marrow), presentation at age less than two years- mortality rises to less than 50% and thirdly spread of disease to various bones or soft tissues. In general, it is considered that the younger the patient, the worse the prognosis.[2,3]

Taking into consideration the age of the patient at the time of presentation and identification of the location as a “single site CNS risk region”, chemotherapy (LCH III protocol) was considered the treatment of choice in the present case report.

Several large multi- centre therapeutic trials have shown that the single best prognostic indicator is a patient’s response to chemotherapy during the six week induction phase. Patients who respond to chemotherapy have been shown to have a 88%-91% survival rate.[9,10] A two month follow up plain MDCT face/

skull showed the regression of the lesion to less than 50% size suggesting disease stability. A six month follow up of the patient showed complete resolution of the lesion but long term periodic follow up is required to identify disease recurrence or late stage complications.

CONCLUSION

Due to its rare occurrence and unassuming appearance, most clinicians may ignore or overlook the possibility of diseases such as LCH on routine oral examination and often diagnose and treat it as commonly occurring conditions such as eruption hematoma. This case report brings to the attention of our fraternity how early diagnosis, periodic recall and multidisciplinary management in a timely manner can help to gain better treatment outcomes with fewer chances of disease progression.

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CASE REPORT

Guided Bone Regeneration in Apicoectomy surgeries: 5 Case series with discussion

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ABSTRACT:

Apicoectomy is one of the most commonly performed endodontic surgeries. Though this surgery often results in complete resolution of signs and symptoms of the surgical area like a sinus opening or swellings, it seldom gives a radiographical evidence of bone formation in the surgical site. Guided bone regeneration using particulate bone grafts mixed with Platelet Rich Fibrin (PRF) and barrier membrane can be effectively used for enhancing the predictability of this surgery. A case series of such a few cases are discussed here to bring into light the application of such a technique that take into consideration the wider application of periodontal regenerative techniques.

KEYWORDS: Apicoectomy, ,barrier membrane, bone graft, regenerative therapy

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INTRODUCTION

Apicoectomy surgery is often considered the final attempt to save an endodontically treated tooth that fail to eliminate a periapical lesion. Surgical intervention is usually considered in cases with infection remaining in inaccessible apical areas and extra radicular infection with bacteria present in dentinal tubules.[1]

This surgery is usually directed at achieving a complete excavation of a periapical lesion and seldom directed at achieving a complete regeneration of the bony cavity that is left as a void.[1] Such bony cavities usually get filled by bone but their chance of natural healing is very less. Guided bone regeneration aiding the use of bone graft, Platelet Rich Fibrin and barrier membranes can be effectively used in such surgeries especially in long standing chronic lesions to achieve a complete bone fill in the cavities.[2,3,4] When bone graft provide needed scaffold for bone regeneration, PRF provide growth factors and the barrier membrane prevent the soft tissue growth into the defect.

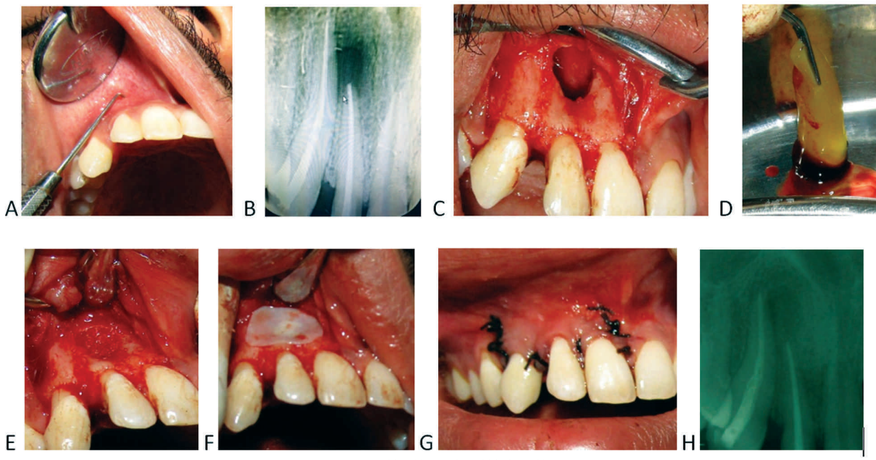
Many times, bone grafting procedure becomes expensive if graft material alone is used in big defects and hence usage of PRf would help in reducing the

bone graft material required for filling the bony cavity. Few cases of successful application of bone graft, PRF and barrier membrane in apicoectomy surgery is presented here to highlight its importance in eliminating periapical lesion and achieving a perfect bony fill of the lesion and render support to tooth in its periapical region.

CASE REPORTS

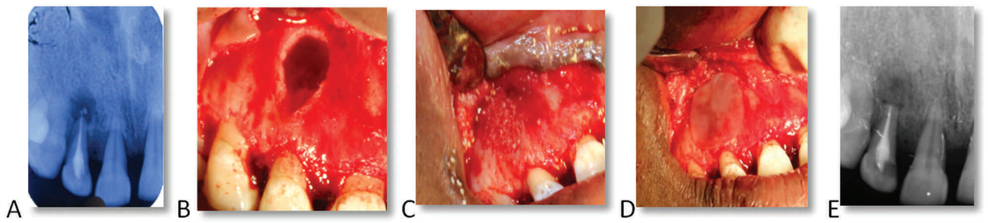
In case series 1, a 37 year old female patient reported with a complaint of pain and swelling in the region of upper right anterior teeth. She presented a history of endodontic treatment done 5 yrs ago. She was indicated for apicoectomy surgery and she was undertaken for surgery with bone grafts, PRF and barrier membrane. The sutures was removed 10 days post operatively and X ray review was done at the end of 6th month. The case reported promising result with complete bone regeneration at the apex. Similar four more cases are explained as Case series 2-5.

Fig: 1 series : Preoperative clinical view (A), Radiographic view (B), Intra op lesion view (C), PRF (D) , Lesion filled with bone graft material (Osseograft ™)mixed with PRF (E), Barrier membrane in place (F), Sutures securing the lesion (G), Post Op radiograph at 6th month (H)



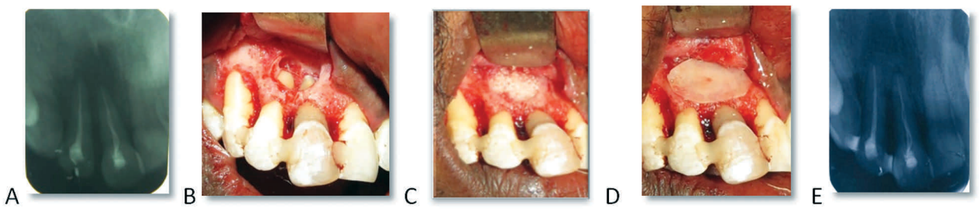
CASE REPORT: 2

Pre op X Ray (A), Lesion (B), Bone graft mixed with PRF in lesion(C), Membrane(D), 6th month Post Op X Ray (E)



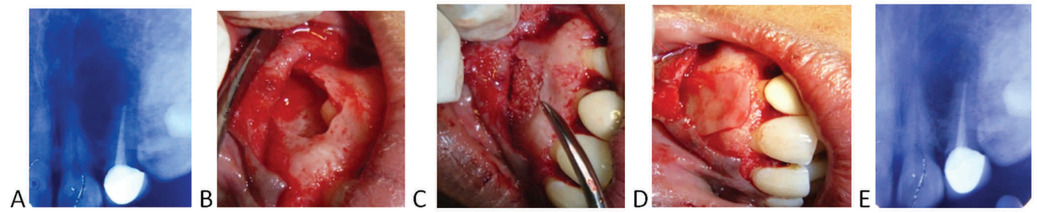
CASE REPORT :3

Pre op X Ray (A), Lesion (B), Bone graft mixed with PRF in lesion(C), Membrane(D), 6th month Post Op X Ray (E)



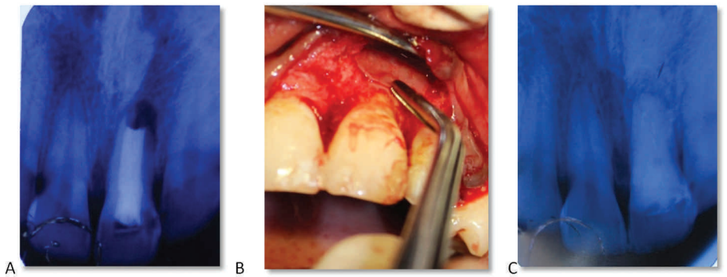
CASE REPORT 4:

Pre op X Ray (A), Lesion (B), Bone graft mixed with PRF in lesion(C), Membrane(D), 6th month Post Op X Ray (E)



CASE REPORT 5:

Pre op X Ray (A), Bone graft mixed with PRF and secured with Membrane in lesion (B), 6th month Post Op X Ray (C)



DISCUSSION

The predictability and success rate of regenerative techniques have secured their place as a standard treatment modality in the field of Oral surgery and Periodontics. From the above mentioned 5 case series, the placement of a barrier membrane supported by a underlying bone graft and PRF have resulted in considerable amount of bone fill in peri apical areas of endodontically treated teeth which failed to create bone regeneration at its apex. Various studies have demonstrated promising results and have thus opened up a wider platform for applying this combination technique in regeneration of bone around dental implant[4],endodontic lesions[5] as well as for socket preservations following extractions. [5]

CONCLUSION

Based on these case reports and similar cases in literature, the usage of bone graft material mixed with PRF and secured with barrier membrane can be considered a reliable technique in achieving a complete heal of peri apical bony defects. PRF being mixed with bone grafts helps in reducing the larger need of particulate bone graft material and thereby reducing the huge cost involved in the surgery. However the reason for not achieving a complete bone fill in all cases of such defects even after the usage of these predictable materials and technique still remains an unanswered question.

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REVIEW – SHORT COMMUNICATION

3D- printed scaffold – future of periodontal tissue engineering

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INTRODUCTION

The search for an ideal filler material for periodontal regeneration has resulted in the development of different bone grafts. As these materials had limited success, the quest for a more effective regenerative technique resulted in the development of the concept of tissue engineering. This approach consists of a triad of elements like the signalling molecules; scaffold or supporting matrices; and cells. Bone tissue engineering (BTE) is the specific branch of tissue engineering that concentrates on enhancement of bone regeneration and repair by creating alternatives to conventional bone grafting materials.[1]

Scaffold or supporting matrix facilitates cell migration, proliferation, attachment and provides a three-dimensional (3D) spatial distribution of cell population. The requirements for an ideal scaffold material include roughness,[2]specific surface topography,[3]porosity,[4] mechanical strength, [5] hydrophilicity, [6] biocompatibility, biodegradability and bioactivity. As periodontal regeneration involves both soft and hard tissues, the design and balance between the biomaterials and scaffolds becomes more complicated. Hence, "compartmentalization" is necessary for controlling the spatiotemporal events to effect successful regeneration of the periodontal complex. [7] The compartmentalization of tissue can be facilitated by means of an advanced scaffold design known as multiphasic scaffold.

MULTIPHASIC SCAFFOLDS

A multiphasic scaffold can be defined by the variation within the architecture and the chemical composition of the resulting construct, which usually recapitulates to some extent the structural organization or the cellular and biochemical composition of the native tissue. [7] One of the most significant challenges in periodontal regeneration is the inability to achieve functional integration of soft and hard tissues with each other and with the host. The basic

principle behind mutltiphasic scaffold is to create a biomimetic architecture which estabilish the critical structure-function relationship inherent to the native tissues. These fabricated constructs accurately duplicate the anatomy of the defect area to aid cell delivery and timely revascularization while maintaining space for subsequent tissue regeneration. These customized constructs have the provision for 3-dimensional conditions and a porous interconnected network that direct cell attachment, migration and PDL fiber orientation. Recently, computational scaffold designing (3D printing) has been

Table 1: Studies utilizing 3D printed scaffold for periodontal tissue engineering

References	Study type	3D scaffold used		Conclusions
		Bone compartment	PDL compartment	
Park *et al.*[11] 2010	In vivo, nude mice	A porous poly (glycolic acid) (PGA) structure is created by 3D wax printing and seeded with human periodontal ligament cells(hPDL)	A porous poly ε-capro lactone (PCL) structure is created by 3D wax printing and seeded with adenovirus-encoding murine bone morphogenetic protein-7 (Ad-BMP-7)	Newly formed tissue demonstrated the interfacial generation of parallel and obliquely oriented fibers that formed human tooth dentin-ligament-bone complex.
Park *et al.* [12] 2012	In vivo, athymic rats	A PCL scaffold is created by 3D wax printing and seeded with hPDL cells / hPDL cells transduced with Ad-BMP-7	A fiber–guiding scaffold is manufactured and seeded with hPDL cells	The use of fiber guiding hybrid scaffold system resulted in triphasic tissue regeneration.
Lee *et al.* [13] 2014	In vivo, mice	Fused deposition modelling is used for fabricating a triphasic scaffold made of PCL/hydroxyapatite. The construct is compartmentalized by creating microchannels of varying diameters of three phases (100, 600 and 300 μm for cementum, PDL and bone, respectively). PLGA microspheres loaded with biological cues like amelogenin, connective tissue growth factor and BMP-2 are added into different compartments, which further aid in the differentiation. Dental pulp stem cells are also seeded into the construct with type-I collagen gel.		A single stem cell population differentiated into respective periodontal tissue compartments by using the construct's biophysical characteristics, combined with the spatially delivered bioactive cues.
Rasperini et al.[14] 2015	First reported human case. (Case report)	Individualized PCL 3D printed scaffold created. Scaffold contained internal pegs to provide guidance for PDL formation and an internal compartment for the delivery of rhPDGF-BB.		Scaffold was intact without signs of inflammation or dehiscence for a period of 12 months. Then resulted in a 3mm clinical attachment level (CAL) gain and partial root coverage. However, the scaffold was exposed at 13 months. Hence, a rapidly dissolving scaffold with less bulkier design may be a better option.

introduced for the production of the multicompartmental scaffold.

3D PRINTED SCAFFOLDS

3D printing technologies offer a promising platform for periodontal tissue regeneration, which provides customization to match the periodontal defect shape, size and topography. Conventional techniques utilized in 3D fabrication of scaffold are gas foaming, freeze drying, particle leaching, melt molding, phase separation, and fiber bonding.[8] But disadvantages like inconsistency in porosity, configuration and interconnectivity made the researchers to focus on more precise technologies.[9] Some of these newly introduced 3D printing technologies are solid freeform fabrication (SFF), inkjet printing, selective laser sintering (SLS), stereolithography (STL), and extrusion printing (e.g., fused deposition modelling-FDM).[10]

3D PRINTED SCAFFOLD FABRICATION

Good quality images of the periodontal defect are generated with the help of computed tomography scanning after which a 3D model of the site created using CAD program. The 3D generated image will be converted into a stereolithography (STL) format to produce the custom-fit substitute for the defect. STL is a technique that converts CAD design into a solid object (bone borders and PDL interface) by means of a combination of laser photochemistry and software technology. After capturing the periodontal defect image dataset, the exterior borders of the bone region and PDL interface will then be created using periodontal defect topography in the STL surface image. Designed architectures were then subtracted from STL- formatted, 3-D surface topological defect to generate an anatomically fit scaffold (eg: Magics 15, Materialise NV). The final designed scaffold is then assessed for adaptation to the defect with the help of computed tomography in a 3D prototyped model.

3D PRINTED SCAFFOLD IN PERIODONTAL REGENERATION

Applications of 3D printed scaffolds have been recently studied in various periodontal applications. Studies utilizing 3D printed scaffold for periodontal tissue engineering are summarized in Table 1.

LIMITATIONS AND FUTURE DIRECTIONS

Main limitations of these multicompartmental scaffolds include increased stiffness, which make it difficult to precisely adapt to the defect configuration, slower scaffold resorption profile that may impede bone regeneration, lack of clarity in perpendicular periodontal fiber formation and its insertion into the newly formed cementum, technique sensitivity and cost effectiveness.

Periodontal literature on 3D printed scaffolds and related biomaterials are limited. So long term multicenter randomized, clinical trials with adequate number of patients are needed to validate the clinical use of these scaffolds. Future researches should focus on developing thinner, easily adaptable and faster degrading scaffold.

CONCLUSION

The concept of multiphasic constructs for periodontal tissue engineering is in the preliminary stages of development. Translation of the favourable preclinical results into clinical realities may be a major breakthrough in the field of regenerative periodontal therapy.

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REVIEW

A brief insight on salivaomics

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ABSTRACT:

Human saliva reflects the physiologic state of both oral cavity and our body. Salivary diagnostics is an attractive and emerging field in the diagnosis of oral and systemic diseases.Saliva is considered as an attractive diagnostic fluid as it is easy to handle compared to serum and urine. Salivacontains biomolecules such as DNA, mRNA, microRNA, protein, metabolites and microbiota.Thesebiomolecules differ in healthy and diseased states.Salivaomicstechnology is a diagnostic platform to monitor the changes in these biomolecules and help to identify diseases at an early stage. This article provides a brief insight in to the omics- based approach of salivary diagnosis.

KEYWORDS: Saliva, genome, proteome, metabolome, microbiome

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INTRODUCTION

The definitive diagnosis of a disease is conventionally procured by laboratory investigations in supplementary to clinical examination. Earlier detection and diagnosis of a disease is important to deliver appropriate treatment, which can reduce the severity of the disease for the patient.[1]

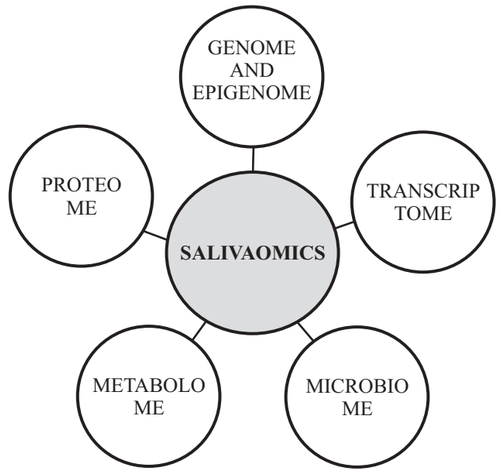
For this, diagnostic tests with high specificity and sensitivity are needed. Biomarkers represent an excellent choice. But, definitive biomarkers for diseases are usually absent. There is also a lack of an accurate portable easy to use diagnostic platform.

Saliva, abiofluid contains secretions of the salivary glands (major and minor), oral mucosa cells, blood and gingival crevicular fluid (GCF). Saliva, similar to blood and serum, contains biomolecules such as DNA, mRNA, microRNA, protein, metabolites and microbiota.A wide range of molecular components in saliva can be measured and monitored and can be compared with serum components. This has made it feasible to study microbes, chemicals and immunologic markers in saliva.[2]

Thus saliva can reflect oral and systemic health status. The main advantage is that it is easy to obtain, non invasive and does not cause discomfort during collection. Also saliva is easier to handle for diagnostic procedures as it does not clot.

SALIVAOMICS

The term salivaomics was coined in 2008 to reflect on various omic constituents of saliva .It includes genome, epigenome, transcriptome, proteome, metabolome and microbiome .[3,4]The main aim is to identify the changes in concentrations of these biomolecules.This helps to identify systemic diseases early, evaluate the prognosis and risk and monitor the response to the treatment.



THE COMPONENTS OF SALIVAOMICS

Genome and Epigenome

Genomics refers to the study of all the DNA of a single organism. The analysis of whole DNA profiles can reflect abnormal pathological genetic processes. Epigenetic processes occur due to environmental exposure of the genome. Studies have proven that these epigenetic factors differ in patterns in diseased and normal individuals.[5] The quality and yield of DNA obtained from saliva is relatively good compared to blood and urine. Salivary DNA can diagnose the presence or absence of certain genes, but cannot provide information about up-regulation and down-regulation of gene expression.

Transcriptome

It includes mRNA and microRNA. These are secreted from cells and enter the oral cavity from salivary glands, GCF, and desquamated oral epithelial cells. [6] The transcription of specific mRNA and microRNA are altered in disease conditions. There is normal 185 core mRNAs in all normal subjects. High density oligonucleotide microarrays were used to profile salivary mRNAs and revealed 3000 mRNAs.[7]

The human salivary transcriptomewas first discovered at UCLA using microarray technology, allowing high throughput analysis. Zhang et_al discovered that four mRNA biomarkers can differentiate patients with early stage resectable pancreatic cancer from non-cancer subjects with high specificity and sensitivity. [8] It can be used to detect oral cancer, ovariancancer, lungcancer, breastcancer, and other systemic diseases.

Micro RNAs are group of small non coding RNAs that are encoded by genes but not translated to proteins. Studies have shown that micro RNAs are deregulated in cancer subjects compared with healthy subjects. Micro RNAs are more stable compared to mRNAs.[8]

Proteome

Proteomics refers to the study of all proteins. Saliva contains more than 2000 proteins which help to maintain homeostasis. Salivary proteins degrade faster compared to that in serum. At UCLA, protease inhibitors are used to stabilize saliva which keep it stable for two weeks (when stored at 4°C).[9]

Mass spectrometry core technology is used to measure peptides. Two dimensional difference gel electrophoresis combined with mass spectrometry is used for proteomic analysis. This analysis is helpful to determine Sjogrens syndrome, lung cancer etc. [10, 11]Chronic periodontitis, oral cancer, and tongue cancer show differential expression of proteins.

Metabolome

This enables the assessment and validation of endogenous small molecular metabolites with in a biological system that has gained increasing popularity and has significance in life sciences. [12] Analysis of these key metabolites is important to monitor the state of biological organisms. These metabolites can discriminate diseased from the healthy subjects. Specific metabolites are elevated in oral cancer, pancreatic cancer, breast cancer, and periodontal disease. [13] This analysis is done using capillary electrophoresis time of flight mass spectrometry.

Microbiome

Oral cavity harbors nearly 10000 species of bacteria. The next generation sequencing helps to identify the association between specific bacteria or other microbes and specific oral or systemic diseases.[14]

Studies have found difference in oral microbiota in patients with pancreatic cancer and squamous cell carcinoma compared with healthy subjects.[14]

MECHANISMS OF SALIVARY DIAGNOSTICS

Studies have shown that some salivary biomarkers might have been derived from systemic sources. Gao et al in mouse models analyzed nerve growth factor and transcription factor production in tumour tissue which can alter the transcriptome of salivary glands and saliva. [15]This helps to identify systemic networks in the human body, which allow communication between distal diseases and salivary glands. Signal transmitted through such networks might induce related signal pathways that result in altered gene expression and protein translation, and thereby produce disease induced salivary biomarker profiles. The research team at UCLA developed Salivaomics Knowledge Database (SKB), a data management system and web resource that supports salivary diagnostics research to overcome the inability to cross reference data sets from different types of studies. SKB includes SALO(Saliva Oncology) and SDxMart.[4] SALO includes the detailed oncology of saliva which can meet the needs of both the clinical diagnostic community and the cross disciplinary community of omic researches. SDxMart is a biomart data portal that hosts salivary proteomic, transcriptomic, metabolomic and microRNA data.

POINT OF CARE PLATFORMS FOR SALIVARY DIAGNOSTICS

The biomarker levels in saliva are very less; so highly sensitive and specific methods are needed to detect this. PCR primed in situ labelling (PRINS) and nucleic acid sequence based amplification (NASBA) are the techniques used to increase the total number of target nucleic acid molecules.[16]

Ligase chain reaction (LCR) and rolling circle amplification (RCA) are used to amplify the probes. Branched DNA (bDNA) and tyramide signal amplification (TSA) provide signal amplification. Integrated system includes saliva collection, detection, a user interface and data presentation. Example of point of care technology is Oral fluid nanosensor.[16]

CONCLUSION

Saliva as a biofluid can accurately denote the presence of a disease, and can be collected in a non-invasive manner. Salivary biomarker evaluation can reflect the overall systemic status of an individual which help to develop personalized medicine concepts.

DIAGNOSTIC KITS BASED ON SALIVARY OMICS

Product (Company Details)	Condition	Analyte	Principle	References
Strand Germline Cancer Test	Cancer risk assessment	DNA	Targets entire coding regions of the BRCA1,BRCA2,and TP53 genes for breast and ovarian cancer predisposition	http://sapienbio.com/speciality genomic panels/
Oral Fluid NanoSensor Test (OFNASET)	Determination of various diseases	Nucleic acid and protein	Polymer micropipetted electrodes Electric induced deposition	http://hspp.dent.ucla.edu /about.html
OraQuick	Screening and risk assessment test for HIV	Protein	Detects antibodies to HIV-1 and HIV-2	http://www.orasure.com/products -infections-oraquick.asp.
Salimark™OC (PeriRxLLC)	Oral cancer risk assessment	Certain discrete biomarkers and protein	Elevation of combinations of biomarkers which are consistent with an increased risk of oral cancer	http://perinc.com/products/oralcancer -salivary-diagnostic test/
My periopath	Periodontal disease	Bacteria	Identifies the type and concentration of specific perio pathogenic bacteria that are known to cause periodontal diseases	http://www.oralna.com/resources/ my periopathcutsheet.pdf

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REVIEW

Correlation of implant protective occlusion with implant failures

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ABSTRACT:

It is believed that dental implants may be more prone to occlusal overloading, which is often regarded as one of the potential causes for peri-implant bone loss and failure of the implant/implant prosthesis. Implant-protective occlusion can be accomplished by increasing the surface area of implants, decreasing the width of the occlusal table, improving the force direction, and reducing the magnification of the force. By doing these things, we can minimize overload on bone-implant interfaces and implant prostheses, to maintain an implant load within the physiological limits of individualized occlusion, and ultimately provide long-term stability of implants and implant prostheses.

Key words: Implant protective occlusion, implant prosthesis

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INTRODUCTION

Endosseous dental implants have successfully been used during the last few decades as a treatment modality for the replacement of missing teeth in partially or completely edentulous patients. The clinical success and longevity of endosseous implants are largely controlled by the mechanical setting they function in.[1] Implant treatment has a high success rate that has been rated as high as 95 to 99%, despite high success rate with endosseous titanium implants, failures unavoidably occur. Optimal oral hygiene and proper occlusion are considered critical for long-term success of endosseous oral implants.[2] Most of the complications like porcelain fracture, unretained prosthesis, screw loosening, bone loss etc occur due to faulty occlusion.

Due to lack of the periodontal ligament, osseointegrated implants, unlike natural teeth, react biomechanically in a different fashion to occlusal force. It is therefore believed that dental implants may be more prone to occlusal overloading, which is often regarded as one of the potential causes for peri-implant bone loss and failure of the

implant/implant prosthesis. Overloading factors that may negatively influence on implant longevity include large cantilevers, parafunctions, improper occlusal designs, and premature contacts. Hence, it is important to control implant occlusion within physiologic limit and thus provide optimal implant load to ensure a long-term implant success.

Occlusal overload can cause mechanical complications on dental implants and implant prostheses such as screw loosening and/or fracture, prosthesis fracture, and implant fracture, eventually leading to compromised implant longevity.[3,4]

The crestal bone around dental implants may act as a fulcrum point for lever action when a force (bending moment) is applied, indicating that peri-implant tissues could be more susceptible to crestal bone loss by applying force.[5] It is essential for clinicians to understand inherent differences between teeth and implants and how force, either normal or excessive force, may influence on implants under occlusal loading.

Differences between teeth and implants

The presence of a periodontal membrane around natural teeth significantly reduces the amount of stress transmitted to the bone, especially at the crestal region. The force transmission is so complete that a thin layer of cortical-like bone (cribriform plate) forms around the tooth. When the tooth is lost, the cortical plate lining disappears, showing that this is a result of ideal strain interface to the bone.[1] Compared with a tooth, the direct bone interface with an implant is not as resilient, so the energy imparted by an occlusal force is not dissipated partially (the displacement of the periodontal membrane dissipates energy) but rather transmits a higher intensity force to the contiguous bone.

The mobility of a natural tooth can increase with occlusal trauma. This movement dissipates stresses and strains. The tooth then returns to normal position once the trauma is eliminated.

Mobility of an implant also can develop under occlusal trauma. However, after the offending element is eliminated, an implant rarely returns to its original rigid condition.

The width of almost every natural tooth is greater than the width of the implant used to replace the tooth. The greater the width of a transosteal structure (tooth or implant), the lesser the magnitude of stress transmitted to the surrounding bone The cross-sectional shape of the natural tooth at the crest is biomechanically optimized to resist lateral (buccolingual)

Tooth versus implant biomechanics[11]

Tooth	Implant
1.Periodontal membrane a. Shock absorber b. Longer force duration c. Distribution of force around tooth d. Tooth mobility can be related to force e. Mobility dissipates lateral force f. Fremitus related to force g. Radiographic changes related to force reversible 2. Biomechanical design a. Elastic modulous similar to bone b. Diameter related to force magnitude 3. Sensory nerve complex in around tooth a. Occlusal trauma induces hyperaemia and leads to cold sensitivity b.Propioception (reduced max. Bite force) c. Less bite functional force 4. Occlusal material: enamel a. Enamel wear, stress lines, abfraction and pits. 5. Surrounding bone- cortical a. Resistant to change	1. Direct bone-implant a. Higher impact force b. Short force duration c. Force primarily to crest d. Implant is always rigid e. Lateral force increases strain to bone f. No fremitus g. Radiographic changes at crest(bone loss) not reversible 2. Implant design a. Round cross section and designed for surgery b. Elastic modulus 5 to 10 times that of cortical bone c. Diameter related to existing bone. 3. No sensory nerves a.Occlusal trauma induces hyperaemia and leads to cold sensitivity b. Occlusal awareness of two to five times less c. Functional bite force four times higher 4. Occlusal material porcelain(metal crown) a. No early signs of force 5. Surrounding bone is trabacular a. Conductive to change

loads because of the bending fracture resistance (moment of inertia) of the tooth and the direction of occlusal forces.

After osseointegration, mechanical stresses and strains beyond the physical limits of hard tissue have been suggested as the primary cause of both initial and long-term bone loss around implants. If the occlusal overload is not corrected, crestal bone loss will continue until the implant fails. Occlusal overload is often regarded as one of the main causes for peri-implant bone loss and implant prosthesis failure, because it can cause crestal bone loss, thus increasing the anaerobic sulcus depth and peri-implant disease states if patients oral hygiene status is poor.[7]

Differences in the magnitude, duration, direction, and frequency of the applied occlusal load and the tolerance threshold of the host are the underlying reasons for the conflicting observations obtained through the clinical studies on occlusal overload. Possible mechanisms of why occlusal overload can lead to peri-implantitis are conceivable. Implants are considered less tolerable to non-axial occlusal load compared to teeth because of a lack of a periodontal ligament. Finite element studies have suggested that the occlusal load is concentrated at the implant marginal bone. Bone remodels in response to the strain. Excessive stress can cause microfracture within bone and eventual bone loss.

Consequences of biomechanical overload[1]

1. Porcelain fracture

2. Prosthesis fracture

3. Uncemented or unretained restoration

4. Screw loosening

5. Early crestal bone loss

6. Intermediate to late implant failure

7. Peri implant disease

8. Component fracture

Principles of implant protective occlusion

1. *No premature occlusal contact*: During maximum intercuspation, no occlusal contact should be premature. Occlusal prematurity between maximum intercuspation and centric relation occlusion should be taken into consideration especially on an implant supported prostheses. This is because, non-mobile implants bear the entire load of the prosthesis when it comes in contact with the mobile natural teeth, hence during the occlusal adjustment between implants and natural teeth, premature occlusal contacts on the implants can occur as the natural teeth can move away from the centric during function.[6]

2. *Influence of surface area*: Sufficient surface area is required to withstand the load transmitted to the prosthesis therefore when an implant of decreased surface area, subjected to increased load in magnitude, direction or duration, the stress and strain in the interfacial tissue will increase. This can be minimized by placing additional implants in the region of concern, ridge augmentation, reduce crown height or by increasing the implant width. Bidez et al have reported a study showing that, forces distributed over 3 abutments results in less stress on the crestal bone compared to 2 abutments

3. *Mutually protected articulation*: When the natural canines are present, during excursions it allows the teeth to distribute horizontal load and also the posterior tooth to disocclude. This concept is known as canine guidance or mutually protected articulation. However, there should be no contact on the implant crown during excursion to the opposing side and also during protrusion. The anterior guidance of implant prosthesis with anterior implant should be shallow. This is because, the steeper the incisal guidance the greater the force on the anterior implants. Weinberg et al have reported a study stating, every 10- degree change in the angle of disclusion, there is a 30 % difference in the load.[1]

4. *Cusp angle of crown*: Natural dentition has steep cuspal inclination whereas in denture teeth, the cuspal inclination given is 30 %. Cusp inclination has been found to produce a high level of torque [6]. For every 10° increase in cusp inclination, there is an approximately 30% increase in torque. Weinberg et al in 1995 have reported a study regarding the torque of a gold screw, abutment screw, and implant. They have concluded that, the cuspal inclination produces the most torque, followed by maxillary horizontal implant offset, while implant inclination and apical implant offset produce minimal torque. Occlusal contact over an implant crown should be on a flat surface perpendicular to implant body. This is achieved by increasing 2 to 3mm of the width of the central groove in the posterior implant crowns and the opposing cusp is recontoured to occlude the central fossa directly over the implant body.

5. *Implant body angle to occlusal load*: There can be different impact on the bone and implant interface based on the direction of the load applied even if it's of same magnitude of force, however implant is mainly designed for long axis load. A study was reported by Binderman in 1970, where 50 endosteal implant designs were assessed and found that all the design sustained lesser under a long axis load. The greater the angle of load to the implant long axis, the greater the compressive, tensile and shear stresses which leads to bone loss and unsuccessful bone re growth.

6. *Crown height:* Implant crown height is often greater than the natural anatomical crown. As the implant crown height becomes greater, the crestal moment with any lateral component of force also becomes greater. Therefore any harmful effect of any feebly selected cusp angle, angled implant body, or angled load to the crown will be magnified by the crown height measurements.

7. *Cantilever*: Cantilevers with unfavourable crown or implant ratio, increase the amount of stress to the implant. These can further lead to peri implant bone loss and prosthesis failure. The magnitude of load obtained by the implants is approximately proportional to the length of the cantilevers but it also varies with the implant number, spacing, and location. Long cantilevers are correlated with increase crestal bone lost.

8. *Occlusal contact position:* Occlusal contact position determines the direction of force especially during parafunctional activity. In different theories, the number of occlusal contact varies. Occlusal theory by Peter K Thomas suggest that there should be tripod contact on each occluding cusp, on each marginal ridge and central fossa with 18 and 15 individual occlusal contacts on a mandibular and maxillary molars whereas, the other oclusal contact scheme indicates that, number of occlusal contact for molars can be reduced.

9. *Implant crown contour*: In maxilla, the edentulous ridge resorbs gradually in the medial direction whereas in posterior mandible, the resorption occurs in lingual direction. Center of implant is placed in the center of the edentulous ridge because the ridge resorbs lingually with resorption hence the implant is mostly not kept under the buccal cusp tip but near the central fossa or more lingually, under the lingual cusp of the natural tooth. The size of the implant body which is the buccolingual dimension is smaller than the natural tooth.[1]

10. *Occlusal material*: Occlusal material fracture is one of the most common complications of implant restoration therefore consideration of the occlusal material restoration is very essential for each patient. Occlusal material may be evaluated by esthetic, impact force, static load, chewing efficiency, fracture, wear, inter arch space requirement, and accuracy of casting.[3]

CONCLUSION

The objectives of implant occlusion are to minimize overload on the bone–implant interface and implant prosthesis, to maintain implant load within the physiological limits of individualized occlusion, and finally to provide long-term stability of implants and implant prostheses. To accomplish these objectives, increased support area, improved force direction,

and reduced force magnifications are indispensable factors in implant occlusion.

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REVIEW

Advances in dental local anesthesia techniques and devices

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ABSTRACT:

Pain and its successful management have been one of the cornerstones of Dentistry worldwide since time immemorial. Although local anesthesia remains the backbone of pain control in dentistry, researches are going on to seek new and better means of managing the pain. It is imperative on our part to update our knowledge and skills in using newer alternatives in pain control and management and ways of administering them. Most of the researches are focused on improvement in the area of anesthetic agents, delivery devices and techniques involved. Newer technologies have been developed that can assist the dentist in providing enhanced pain relief with reduced injection pain and fewer adverse effects. This overview will enlighten the practicing dentists regarding newer devices and methods of rendering pain control compared with the earlier used ones on the basis of research and clinical studies available.

Keywords:- Local anesthesia, CCLAD, intra-osseous anesthesia

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INTRODUCTION

The most important skill required of all dental practitioners is the ability to provide safe and effective local anesthesia (LA). The injection of local anesthetic is perhaps the greatest source of patient fear and inability to obtain adequate pain control with minimal discomfort remains a significant concern of dental practitioners.[1,2,3,4,5] Over the years, many futile attempts have been made to provide clinically adequate pain control without the need for injection of drugs.[6]The agents and anesthetic delivery equipments available today provide the practitioner an array of options to effectively manage the pain associated with dental procedures. This review focuses on the most recent developments in dental LA techniques and devices.

EMLA

Eutectic Mixture of Local Anesthetics: It contains a mixture of lignocaine and prilocaine bases, which forms an oil phase in the cream and passes through the intact skin. Clarke et al suggested the use of EMLA cream for anesthetizing the skin prior to needle insertion as this reduces the incidence of injection pain.[6]

DENTIPATCH [INTRAORAL LIGNOCAINE PATCH]

Dentipatch contains 10-20% lidocaine, which is placed on dried mucosa for 15 minutes. Hersh et al studied the efficacy of this patch and recommended it for use in achieving topical anesthesia for injections in both maxilla and mandible. It is not recommended in children. Disadvantages include central nervous system and cardiovascular system complications.[7]

ELECTRONIC DENTAL ANESTHESIA (EDA)

This technique is based on transcutaneous electronic nerve stimulation (TENS), where electronic waves are used to disrupt neural pain transmission to brain. [8] It can be used a supplement to conventional local anesthesia. Some limitations of this technique are increased salivary flow and inability to use metal instruments freely. It is contraindicated in several conditions such as heart disease, seizures, neurological disorders, brain tumors, patients wearing pacemakers and cochlear implants.

JET INJECTORS

Jet-injection technology is based on the principle of using a mechanical energy source to create a release of pressure sufficient to push a dose of liquid medication through a very small orifice, creating a thin column of fluid with enough force so that it can penetrate soft tissue into the subcutaneous tissue without a needle. Jet injectors are believed to offer advantages over traditional needle injectors by being fast and easy to use, with little or no pain, less tissue damage, and faster drug absorption at the injection site.[9,10] Controlled studies evaluating efficacy are lacking, and reports are primarily anecdotal. To date, the effectiveness of the technique in dentistry has been reported to be limited.[11,12]

COMPUTER-CONTROLLED LOCAL ANESTHETIC DELIVERY SYSTEMS

In the mid-1990s, work began on the development of local anesthetic delivery systems that incorporated computer technology to control the rate of flow of the anesthetic solution through the needle. This concept is now called computer-controlled local anesthetic delivery (CCLAD).[13] The first of these CCLAD devices, the Wand™ (Milestone Scientific, Inc., Livingston, N.J.), was introduced in 1997. Subsequent versions from same manufacturers were named Wand Plus and CompuDent™, the current designation. In 2001, the Comfort Control Syringe (Dentsply International, York, PA, USA) was marketed as an alternative to the Wand. Examples of similar products include the QuickSleeper and SleeperOne devices (Dental Hi Tec, Cholet, France),Anaeject (Nippon Shika Yakuhin, Shimonoseki, Japan) and Ora Star (Showa Uyakuhin Kako, Tokyo, Japan) syringes.

WAND/COMPUDENT SYSTEM

This system enables the operator to accurately manipulate needle placement with fingertip accuracy and deliver the LA with a foot-activated control. The lightweight handpiece is held in a pen-like grasp that provides the user with greater tactile sensation and control, compared to a traditional syringe. The available flow rates of LA delivery are controlled by a computer and thus remain consistent from one injection to the next. The greater control over the syringe and the fixed flow rates of the LA drug are responsible for a significantly improved injection experience, as demonstrated in many clinical studies conducted with CCLAD devices in dentistry.[14,15,16,17] A growing number of clinical trials in medicine also demonstrate measurable benefits of CCLAD technology.[18,19]

COMFORT CONTROL SYRINGE

The Comfort Control Syringe differs from the Milestone products in that there is no foot pedal. It has two main components: A base unit and a syringe. Several functions of the unit, most importantly injection and aspiration, can be controlled directly from the syringe, possibly making its use easier to master for practitioners accustomed to the traditional manual syringe. The Comfort Control Syringe has five pre-programmed speeds for different injection techniques and can be used for all injection techniques. Although, use of the Comfort Control Syringe may be more perceptive than that of the CompuDent system in the sense that the injection is controlled by hand, the syringe is bulky and more cumbersome to use than the Wand handpiece.[20,21]A comparison between the traditional dental syringe and the Comfort Control Syringe revealed no meaningful differences in ease of administration, injection pain and efficacy, and acceptance by patients.[5]

SINGLE-TOOTH ANESTHESIA [STA]

In 2006, the manufacturers of the original CCLAD, the Wand, introduced a new device, Single Tooth Anesthesia (STA™) which incorporates dynamic pressure-sensing (DPS) technology that provides a constant monitoring of the exit pressure of the local anesthetic solution in real time during all phases of the drug's administration.[21]STA with DPS technology can be used to give Palatal Anterior Superior Alveolar, Anterior and Middle Superior Alveolar, Periodontal Ligament injections. It overcomes the problems associated with the traditional PDL injections. The system can be utilized for all traditional intraoral injection techniques. The DPS system provides confirmation (in audible tones, visual displays and spoken alerts) that the needle tip is in the desired location and has not moved outside this area during drug administration. DPS alerts the user if leakage of LA occurs (a common problem

when traditional syringes are used for the PDL). Since the pressure of the LA is strictly regulated by the STA system, a greater volume of LA can be administered with increased comfort and less tissue damage than seen with traditional syringes or PDL pressure devices.[22] It has 3 modes for rate of injection: STA mode, normal mode and turbo mode.

INTRA-OSSEOUS ANESTHESIA SYSTEMS [IO-SYSTEMS]

Aim of intra-osseous anesthesia is to inject local anesthesia solution into cancellous bone adjacent to the apex of the tooth by piercing buccal gingiva and bone in relation to the tooth to be anesthetized. It can be used as a supplemental technique with mandibular nerve blocks to enhance deep pulpal anesthesia or as a primary technique so that patients do not experience numb lips or tongues postoperatively. Systems include Stabident, X-Tip and IntraFlow. Stabident, an intra-osseous Injection delivery system has a disadvantage that it can be used only in visible and readily accessible areas because while giving intraoral injection, once the perforator is withdrawn, it can be extremely difficult to locate the perforation site with the anesthetic needle. To overcome this, X-Tip uses the pilot drill which is a hollow tube through which a 27-gauge needle can pass. The initial drill stays in place, allowing the anesthetic to be placed without hunting for the hole that was just created. The above two systems use a two-step method. IntraFlow anesthesia system further eases the IO injection by using a single-step method which allows entry into the penetration zone, injection, and withdrawal in one continuous step, without the need to relocate the perforation site. Reemers et al reported that the IntraFlow system as a primary technique provides reliable anesthesia of posterior mandibular teeth in 13 of 15 subjects, [23] compared to 9 of 15 with an inferior alveolar nerve block. Nusstein et al found supplemental mandibular intraosseous injection using the Stabident system and 1.8 mL of 2% lidocaine with 1:100,000 epinephrine was 88% successful in gaining total pulpal anesthesia for posterior teeth diagnosed with irreversible pulpitis.[24]

INTRA NASAL LOCAL ANESTHESIA

In the past, the use of nasal mucosa was conventional due to the high blood supply and ability to achieve the systemic effects of drugs. Nowadays for the nasal mucosa and even upper teeth numbness, anesthetic drugs (especially tetracaine) are used on the nasal mucosa. Studies have shown that the use of intranasal tetracaine with a vasoconstrictor such as oxymetazoline can provide tooth anesthesia for the first molar on one side to the first molar on the other side and dental procedures can be performed for the teeth, without need to inject anesthetic drugs. [8]

TENS (TRANSCUTANEOUS ELECTRONIC NERVE STIMULATION)

The result of this method in patient comfort and it provides less pain during the injection. This has been demonstrated especially for Inferior Alveolar Nerve block techniques, while topical anesthesia does not cause significant changes to reduce pain during the injection. This technique stimulates the nervous system and it starts before injecting and the pulse rate increases to make a good shake to the patient. The needle is inserted at an area between the electrodes of TENS while generated impulses are continuing at the same level. After withdrawing the injection and removing the needle, pulses are slowly reduced and stopped. [25]

CONCLUSION

Many newer delivery systems for local anesthesia have evolved and the dental practitioners must be well aware of their usage and applications. The required armamentarium may be chosen according to the patient's needs. Dentists must be well aware of these newer delivery systems, their usage and must have an up-to-date knowledge, so as to provide the benefits of latest technology to their patients. The ability to deliver painless injections and a desirable level and duration of anesthesia results in reduced patient fear, reduced patient stress and therefore reduced stress for the clinician and can aid patient compliance with dental treatment.

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REVIEW

Biologic width: the Prosthodontic perspective

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ABSTRACT:

The first and most basic objective of restorative dentistry is preservation of the tooth structure. However, for the long-term survival of restoration, the periodontium must also remain healthy or vice versa. An adequate understanding of the relationship between periodontal tissues and restorative dentistry is paramount to ensure adequate form, function, esthetics, and comfort of the dentition. While most clinicians are aware of this important relationship, uncertainty remains regarding specific concepts such as the biologic width and indications and applications for surgical crown lengthening. This review discusses the concept of the biologic width and its relationship to periodontal health and restorative dentistry. The importance of restorative margin location, materials, and contours related to periodontal health is also addressed.

Key words: Biologic width, periodontium, restoration, esthetics, subgingival margins , tissue damage

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INTRODUCTION

Dentistry of the modern era is dominated by restorative procedures that not only retain the functions of lost structures but also needs to retain the esthetics. Functional and esthetic restorations can gain complete patient's and dentist's satisfaction only when these restorations exist in harmonious relationship with the surrounding structures. Often dental practitioners come across to cases with chief complaints of a problematic or faulty restorations that appear to be normal to an untrained eye. Consistent complaint of the patient towards the inconvenience, makes the dentist to examine the regions with restorations and such cases are diagnosed as the restorations violating the biologic width.

BIOLOGICAL WIDTH

Biologic width is defined as the dimension of the soft tissue, which is attached to the portion of the tooth coronal to the crest of alveolar bone.

Biologic width is the term applied to the dimensional width of dentogingival junction (epithelial attachment and underlying connective tissue.The concept of biologic width was initiated by Gargiulo et al in 1961. The term biologic width was coined by D Walter Cohen. [1]

SIGNIFICANCE

The significance of biologic width is that, it acts as a barrier and prevents penetration of microorganisms into the periodontium. Maintenance of biologic width is essential to preserve the periodontal health and to remove any irritation that may damage the periodontium. It is said that a minimum of 3mm space between the restoration margin and the alveolar bone is required to permit adequate healing and to maintain a healthy periodontium. This 3 mm consists of 1mm of supraalveolar connective tissue, 1mm of junctional epithelium and 1mm of sulcular depth. This allows for adequate biologic width (2.04mm) even when the margins are placed 0.5mm within the sulcus. The location, fit and finish of restorative margins are critical factors in the maintenance of periodontal health.[1,2]

CATEGORIES OF BIOLOGIC WIDTH

In order to operationally define biologic width, Kois suggested that the restorative dentist must determine the total distance from the gingival crest to the alveolar crest. This procedure is termed bone sounding.The Glossary of Periodontal terms describes sounding as the penetration of anesthetized soft tissue by a probe in order to determine the topography of the alveolar process.

The patient is anesthetized and the periodontal probe is placed in the sulcus and pushed through the attachment apparatus until the tip of the probe engages alveolar bone. The measurements are made on anterior teeth mid-facially and at the facial or interproximal line angles[3].

- ❖ Normal-crest patient
- ❖ High-crest patient
- ❖ Low-crest patient

IMPORTANCE OF DETERMINING THE CREST CATEGORY

Determination of the crest category allows the operator to determine the optimal position of margin placement, as well as inform the patient of the probable long-term effects of the crown margin on gingival health and esthetics.[4]

BIOLOGICAL CONSIDERATION

Restorative clinician have a narrow margin of error in order to achieve a good esthetic restoration which is fully functional as well as best suited for patient health. Restorative dentist should know the importance of biological width in preserving the healthy and esthetically good looking gingival form around the tooth and implant.

EFFECTS OF BIOLOGICAL WIDTH VIOLATION

The restorative procedure are technique sensitive and involves a great deal of understanding of the anatomy, function and condition of the teeth or implants and their surrounding structure. Placing restorative margin within the biologic width frequently leads to: [5]

- ❖ Gingival Inflammation.
- ❖ Clinical Attachment Loss.
- ❖ Bone Loss.

Clinically these sign of biological width violation appear as a pain around the restoration margin, bleeding from the inflamed gingival margin area of involved tooth and gingival recession.

EVALUATION OF BIOLOGIC WIDTH VIOLATION

If a patient having discomfort when restorative margin levels are assessed with a probe , it is a good indication for biologic width violation. The most important diagnostic method is bone sounding, which is done by probing under local anesthesia to bone level. Biologic width is assessed by subtracting the sulcular depth from the resulting bone sounding measurement. If this distance is less than 2mm, then a violation of biologic width can be diagnosed. Radiographic evaluation can assess interproximal violation of biologic width. But it is not diagnostic because of tooth superimposition.[1]

CORRECTION OF BIOLOGIC WIDTH VIOLATION

Biologic width violation can be corrected surgically or orthodontically. Surgical correction is aimed at removing the bone away from the restorative margin while in orthodontic correction, the tooth is moved coronally away from the bone. Surgical correction is done by gingivectomy, apically repositioned flap with or without ostectomy. Orthodontic correction is done either by slow eruption or forced eruption with supracrestalfiberotomy.[6]

The mode of treatment is chosen based on the width of attached gingiva present, biologic width measurements as obtained from bone sounding, and esthetic requirements [1]

TYPES OF RESTORATIVE MARGINS

The restoration margins can be grouped in any of the following three categories: - supragingival, equigingival, and subgingival.[6]

Supragingival margin

It is the least irritating to the periodontium and is easy to prepare. The final fit and finish of the margins and removal of excess cement are also the easiest to achieve. Though this type of margin has the least impact to the periodontium, it is unaesthetic and preferred only in non-esthetic areas.

Equigingival margin

Equigingival margin can be easily blended with the tooth and can be finished easily to provide a smooth and polished margins. But such margins are not desirable as they are thought to favor more plaque accumulation and therefore result in greater gingival inflammation.

Subgingival margin

Though it is esthetic, it is detrimental to periodontal health as it acts as a permanent irritant to the periodontium. Many studies have demonstrated qualitative and quantitative changes in subgingival microbes, increased plaque index, gingival recession and pocket depth.

Biologic width encroachment becomes more common when planning for subgingival restorations in cases that are fractured or carious, near the alveolar crest. Also esthetics demands often require hiding of restorative margins below the gingival margins i.e., pushing them down into the sulcus, which may cause biologic width violation.[7]

It is widely believed that the best biological place for a restorative margin is supragingival. Supragingival margins stay away from the periodontal tissues, and have the following advantages:• Preservation of tooth structure during tooth preparation.

- Impressions are more predictable, with minimal or no cord packing.
- Provisional restorations are easier to make, and the soft tissues will be healthier when the patient returns for cementation of the final restoration.
- Removing excess cement is much easier when the margin is visible.

Conventionally equigingival margins were not recommended as they were thought to retain more plaque than supragingival or subgingival margins and therefore cause greater gingival inflammation. There was also the concern that any minor gingival recession would create an unsightly margin display. These concerns are not valid today, not only because the restoration margins can be esthetically blended with the tooth but also because restorations can be finished easily to provide a smooth, polished interface at the gingival margin. From a periodontal viewpoint, both supragingival and equigingival margins are well tolerated. The greatest biologic risk occurs when placing subgingival or equigingival margins for finishing procedures, and in addition, if the margin is placed too far below the gingival tissue crest, it violates the gingival attachment apparatus. Not only do restorative margins placed subgingivally risk invading the attachment apparatus, but also unwanted tissue effects appear to result merely due to their subgingival location, regardless of the depth of the sulcus penetration.[8]

CRITERIA FOR PLACEMENT OF MARGIN[7,8]

The following three rules can be used to place subgingival margins:

- If the sulcus probes 1.5 mm or less, place the restoration margin 0.5 mm below the gingival tissue crest. This is especially important on the facial aspect.
- If the sulcus probes more than 1.5 mm, place the margin one half the depth of the sulcus below the tissue crest. This places the margin far enough below the tissue so that it still is covered if the patient is at higher risk of recession.
- If a sulcus greater than 2 mm is found, especially on the facial aspect of the tooth, then evaluate to see whether a gingivectomy could be performed to lengthen the teeth and create a 1.5 mm sulcus.

FINISH LINE/RESTORATION MARGIN DESIGN

Beveled shoulder

When porcelain-fused-to-metal (PFM) restorations were introduced, the metal collar was considered an ideal margin for this type of prosthesis. Thus, the prescribed finishing line was the beveled shoulder, based on the notion that its use would reduce the marginal opening of the gold casting.

Knife edge

For PFM restorations if a knife-edge finishing line is to be used then the butt joint necessary to accommodate the porcelain has to be created within the metal coping further coronally. Despite its theoretical conservatism, combination of this finishing line with PFM restorations tends to under-prepare the axial walls leading to the resulting crown being bulky and unaesthetic. Conversely, the preparation may become overtapered leading to an unretentive final restoration.

Flat shoulder

This design has, over time, replaced the beveled shoulder as the resulting butt joint permits the use of a bulk of porcelain at the

margin, thus removing the need for a metal collar.

A shoulder width of 1 mm to 1.5 mm at a 90° to 100° angle to the root surface is ideal. The axial line angle should be rounded to reduce stress concentration in that area. This design is sometimes referred to as the radial shoulder..

Chamfer

This is now the finishing line of choice for most cast veneer preparations and hence recommended for most ceramic restorations. Chamfers are less likely to have undercuts and are generally considered to be more conservative than shoulder preparations although a similar degree of tooth reduction is required.

CRITERIA FOR SELECTION OF FINISH LINE

The following criteria for margin selection seem reasonable:

a. The selected margin must provide a predictable level of marginal integrity. The cervical margin designs that meet this criterion include: The shoulder, the shoulder bevel, and the slant shoulder.

b. The shoulder and shoulder bevel meet the criterion to provide smooth materials to the gingival sulcus so as to minimize plaque accumulation. The shoulder can be used with a metal margin, which can be highly polished, or with a porcelain margin, which results in glazed porcelain in the sulcus.

c. In situations where esthetics are important, the clinician has three options.

- For an all-ceramic crown, a shoulder margin with a rounded internal angle or a deep chamfer should be prepared to end at approximately 90 to the external angle of the labial or buccal surface with a depth of 1 and 1.5 mm.
- Traditional metal-ceramic restorations are completely opaque, thus preventing light from passing into the tooth and root. This results in a root that appears dark, and the margin appears gray; even the gingiva appears gray. When using highly translucent feldspathic porcelain clinicians can achieve a “contact lens” effect, making the margin disappear. As a result there is no need to hide the margin subgingivally.
- When using a more opaque zirconia crown the margin can safely be placed at the gingival margin in the esthetic zone.[8]

CONCLUSION

The health of the periodontal tissues is dependent on properly designed restorations. Undoubtedly it is preferable if margins can remain coronal to the free gingival margin. Obviously, subgingival margin placement is often unavoidable. If restorative margins need to be placed near the alveolar crest, crown-lengthening surgery or orthodontic extrusion should be consideredto provide adequate tooth structure while simultaneously assuring the integrity of the biologic width. Although individual variations exist in the soft tissue attachment around teeth, a minimum of 3 mm should exist from the restorative margin to the alveolar bone, allowing for 2 mm of biologic width space and 1 mm for sulcus depth.

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REVIEW

Intricacies in Osseoperception : A changing scenario from proprioception

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ABSTRACT:

The periodontal ligament, which connects the root of the tooth to the jaw bone, contains many mechanoreceptors that provides the tactile function and fine tuning of jaw motor control. Extraction of tooth will remove these receptors and reduce the intra-oral neural input to the brain. The rehabilitation of edentulism by means of endosseous implants leads to an improvement in the sensory and motor functions but fail to reach the same level of sensitivity as dentate subjects. 'Osseoperception' is defined as a perception of external stimuli transmitted via the implant through the bone by activation of receptors located in the peri-implant environment, the periosteum, the skin, the muscles and/or the joints.

Keywords: Proprioception, osseointegration, osseopercetion, oral kinaesthesia

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INTRODUCTION

In humans, perception is enabled by several kinds of sensory systems which include vision, audition, balance, somatic function, taste and smell.[1] The initial contact with the external world is made through special neural structures called sensory receptors or end organs.

The human somatic sensory system have four types of afferent nerve fibres : Aα, Aβ, Aδ and C. Based on the structure as well as signalling properties, receptors can be divided into several classes including thermoreceptors, nociceptors and mechanoreceptors.[2] In the periodontal ligament (PDL) free nerve endings are present which may be responsive to pain. The majority of the receptors located within the periodontal ligament are of the mechanoreceptive type. The periodontal ligament acts as the medium of occlusal force transfer and it acts as a shock absorber for occlusal loads and as a hydraulic damper serving to reduce the magnitude of loads that are transferred to the surrounding alveolar bone. Based on this behaviour, it is anticipated that the magnitudes of strain and distribution in the alveolus will be altered by removal of the PDL. Additionally, the PDL acts as a highly viscoelastic material. Any condition influencing the periodontal mechanoreceptors, alters the sensory feedback pathway and thus affect the tactile function and fine tuning of jaw motor control.

Periodontal ligament and proprioception

Proprioception is the ability to sense stimuli arising within the body regarding position, motion, and equilibrium. One of the main functions of the periodontal ligament in masticatory cycle is to provide sensory feedback during chewing. Humans are capable of detecting the presence of even very small particles between the occlusal surfaces of teeth. The teeth also can serve as an excellent judge of assessing material properties. There are proprioceptive sensors in the PDL that provide sensory information about how fast and hard to bite.[3] The unconscious feedback mechanisms of the PDL play a significant role in the proper mechanical function of the masticatory system by assisting in particle identification and maintaining appropriate force application.

Oral mechanoreceptors may be classified on the basis of their response properties into two main categories: slowly adapting (SA) types and rapidly adapting (RA) types. These two categories are associated with the sensations of touch-pressure (SA types) and flutter-vibration (RA types). The structures which mediate mechanosensation in the mouth include Merkel cell complexes, Ruffini type endings, Meissner endings and Pacinian corpuscles. Refined mechanoreceptive properties of the receptors in the periodontal ligament are likely to be related to an intimate contact between collagen fibres and Ruffini –like endings.[4]Dense innervations of myelinated nerve fibres are distributed heterogeneously in the human PDL and with increased density in the loaded (i.e. the apical) areas.[5,6]

Tooth extraction may results in alteration in oral motor behaviour as well as natural masticatory function.[7] Extraction will also result in loss of periodontal mechanoreceptors as well as intradental nociceptors.[8] Replacement of the extracted tooth can be done by either removable or fixed prostheses. The introduction of osseointegration has led to the successful placement of implant-supported restorations in edentulous and partially edentulous patients.[9,10,11]

Dental implants are being used to support removable and fixed reconstructions, thus rendering long-term predictable outcomes in fully and partially edentulous patients and in patients with single tooth gaps. Even though there are several advantages for implant prostheses, lack of proprioception is a major disadvantage.

Concept of osseoperception

Osseoperception is defined as mechanoreception in the absence of a functional periodontal mechanoreceptive input and it is considered to be derived from TMJ, muscle, cutaneous, mucosal, periosteal mechanoreceptors which provide mechanosensory information for oral kinaesthetic sensibility in relation to the jaw function and the contacts of artificial teeth.[12,13]The phenomenon of osseoperception of implants was first noted by Haraldson et al in 1979.[14]According to him bone anchored prostheses in edentulous patients transmit sensory information via a protective neuromuscular pathway.Perceptions of static jaw position and velocity of jaw movement (whether imposed or voluntarily generated) and forces generated during contractions of jaw muscles constitute oral kinaesthetic and proprioceptive sensations.[15]Extensive studies are available on the neural basis of limb kinaesthetic sensibility, but only less information is available on oral kinaesthesia in dentate individuals as well as in patients with implant supported prosthesis.

Bone innervation includes both myelinated and unmyelinated nerve fibers located in the periosteum, bone cortex, Haversian systems, Volkmann's canals, and the marrow spaces. Peri-implant neurogenesis is one of the underlying mechanisms governing the phenomenon of osseoperception. Histomorphometric evidence have shown the presence of Myelinated nerve fibres which densely populates the peri-implant crestal gingival and apical regions, although they were also identified in the woven bone and in the osteons near the implant threads, largely contribute to the osseoperception of dental implants

The mechanism of oral kinaesthesia is similar to limb kinaesthesia. The CNS has two mechanisms to operate for oral kinaesthetic perception.

- The first is by monitoring a collateral discharge of the descending central command to muscles. The function of this mechanism is to provide the sensation of muscular force or effort which accompanies centrally generated voluntary motor commands.[15,5,16]An input from Golgi Tendon Organs (GTOs) which is associated with the jaw closing muscles is important in the sensation of effort in voluntary biting. The collateral discharge does not provide a sensation of movement or altered position.
- The second mechanism is derived from mechanoreceptors activated during jaw movements and different jaw positions.

The response of oral mechanoreceptors to natural stimuli is determined by morphological factors such as the nature of the relationship between nerve ending and certain cellular specializations, their distribution in the mucosa, the diameter of their primary afferent nerve fibers, and the central distribution of these fibers in the brainstem. Because of the morphological

similarities to certain cutaneous mechanoreceptors, the mucosal lining may be considered as an internal continuation of the large "receptor sheet" for localization and detection of the mechanical stimuli.

Mechanoreceptors contributing to Osseoperception

(a) Joint mechanoreceptors

These are low-threshold mechanoreceptors which are present in the TMJs of experimental animals and humans[17,18,19] and in other joints of the body.[13] TMJ receptors may play a more significant role[17,20] in signalling movements and positions.

(b) Muscle mechanoreceptors

The two principal mechanoreceptors associated with muscle are GTOs and muscle spindles, which are slowly adapting receptors. Golgi tendon organs are found at the musculo-tendinous junction in series with a small number of extrafusal muscle fibers. The pull of the muscle fibers with muscle contraction results in the activation of GTOs. Golgi tendon organs have been reported in jaw muscles.[21,17,22] They provide detailed information concerning the magnitude of muscle contraction. Besides they play an important role in regulating muscle contraction and signals the intramuscular tension.[23,24,13] These receptors, along with corollary discharge, senses the intramuscular tension generated during voluntary contractions such as biting.

Muscle spindles are the most complex somatosensory receptor in the body[25] which provide detailed information on muscle length and rate of length change. They lie in parallel with extrafusal muscle fibers, have independent sensory innervations, and contain specialized intrafusal fibers. Gamma (δ) motor neurons are the efferent innervation to the intrafusal muscle fibers. With δ-motoneurone discharge, the contraction of intrafusal fibers will contribute to an increased spindle afferent discharge.

During voluntary muscle contraction, both α and δ motoneurones are activated simultaneously (α-δ co-activation), which ensures that muscle spindles maintain their high sensitivity without saturation. The intramuscular receptors in jaw muscles and periodontal mechanoreceptors perform function in the assessment of jaw position and movement. The spindle muscle fibres have afferent discharge that arises from δ motoneurone and as a result of an actual change in muscle length. The Central Nervous system (CNS) have specific mechanisms to distinguish between these afferent discharge.

The δ motoneurone signals are identified by the CNS via corollary discharge. The resultant signals are interpreted by the CNS as muscle length and change in length.[26,27,28] Hence, in the absence of periodontal afferent input, the muscle mechanoreceptors can provide detailed information on jaw position and movement.

(c) Cutaneous mechanoreceptors

These receptors were shown to display a positional sensitivity.[29] Cutaneous receptors in the hairy skin overlying the TMJ can respond to skin deformation which occurs during various movements of condyle. This somatosensory input can provide important proprioceptive information for the control of facial muscles which lacks definitive muscle spindle innervations.[30,31,32] It is also likely that orofacial cutaneous mechanoreceptors exhibit response properties and graded increases in firing rate occurs with the magnitude of the applied mechanical stimulus.[33,34] These response properties may therefore provide information to the CNS concerning the jaw position and its movement.

(d) Mucosal mechanoreceptors

Periodontal mechanoreceptors are responsible for refined interdental discriminative function in the presence of natural teeth.[35] In the case of implant-supported prostheses opposing complete dentures, a contribution to oral kinaesthetic perception could come from the activation of mucosal receptors beneath the complete denture and possibly periosteal and/or mucosal mechanoreceptors in the vicinity of the implant fixture.[36] Mucosal receptors show low thresholds and graded responses to mechanical stimuli that could contribute to assessments of position and velocity of jaw movement at tooth contact, as well as force of muscular contraction.

(e) Periosteal mechanoreceptors

There are few physiological data on the potential role of periosteal mechanoreceptors in oral kinaesthetic perception. The periosteum contains free nerve endings, which include complex encapsulated and unencapsulated endings. These free nerve endings are activated either by pressure or stretching of the periosteum by the action of the masticatory muscles and skin.[37]

Central processing of Somatosensory information for Osseoperception

For mechanoreceptive information to reach conscious perception, it must project to the cerebral cortex. The somatosensory information obtained from the various receptors which include cutaneous and mucosal mechanoreceptors, muscle spindles, and GTOs associated with jaw muscles, as well as TMJ and periodontal mechanoreceptors have been demonstrated at variouslevels of the orofacial somatosensory afferent pathway. These pathways include the trigeminal sensory nucleus, the ventroposteromedial (VPM) nucleus of the thalamus, and the primary somatosensory cortex (SI) in a number of animal species[38,39,40,41] as well as in the human.[42] This information is used for reflexes[43,44] for the modulation of mastication and swallowing,[45,46] for the control of voluntary orofacial movements, oral kinaesthesia and tactile perception. Much of this mechanoreceptive information is capable of being transmitted along somatosensory afferent pathways with high synaptic security.

In the absence of periodontal afferents, an extensive cortical representation of cutaneous, mucosal, and deep somatosensory afferents could contribute, to conscious perceptual experiences associated with kinaesthetic sensibility. Patients with modified somatosensory input following tooth extraction and the subsequent restoration with implant-supported prostheses, insteadof complete dentures, may accommodate to the new intra-oral environment by selectively attending to specific orofacial afferent information in the functional accommodation of the new prosthetic appliances. The fitting of implant-supported prostheses will evoke a change in somatosensory input to the brain that will be markedly different from that occurring with complete dentures. Somatosensory cortical areas may play a role in focusing attention on these specific sensory inputs derived from orofacial mechanoreceptors and provide a framework for the individual to accommodate to this altered intra-oral environment.

After the removal of periodontal input and provision of implant supported prosthesis, plastic changes occur in somatotopic maps in the face motor and somatosensory cortical regions. These plastic changes may be directly associated with the' ability of the individual to accommodate to their new prostheses. Further, the extent of these changes, together with specific treatment differences and individual oro-dental characteristics, may explain why some individuals experience more difficulty than others in the process of accommodating to either fixed or removable prostheses. It is likely that the better the quality of the prostheses in optimizing esthetics, form, and function, the more readily will the sensory-motor system will adapt. It follows that the closer the final prostheses come to restoring original function(e.g.,implant-supported fixed prostheses compared with complete dentures), the closer the sensory-motor system will re-establish its original characteristics.

Several studies have demonstrated that the tactile sensation depends on the implant surface structure.[47,48] He et al proposed a novel design of dental implant, wherein nano-springs were used to construct a stress-cushioning structure inside the implant.[49] This novel design, transfers the main biomechanical interface of the implant from outside to inside, which some extent compensates for the functions of lost periodontium in stress cushioning and proprioception. Future research in the field of implantology might develop new systems with osseointegration and osseoperception.

CONCLUSIONS

Patients with implant- supported prostheses have improved tactile discriminative capabilities and report improved motor function in comparison with those wearing complete dentures as well as removable partial dentures, although their sensory and motor capabilities do not appear to match those of dentate individuals. With the loss of dental and periodontal mechanoreception, other peripheral receptors dominate in afferent projections to the sensorimotor cortex and provide the neural basis for perceptual abilities of patients with implant-supported prostheses. The evidence available on the plasticity of the CNS provides a possible neural basis for our understanding of the accommodation of patients to these changes in dental status. However, it is also likely that an appropriately designed implant-supported restoration, being fixed to bone, more closely resembles the dental status before tooth loss, and this may more appropriately restore the optimal motor as well as sensory functions of the masticatory system.

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Nisha,et al.: Osseoperception

REVIEW

Infection control practices in dentistry

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ABSTRACT:

Infection control is an essential part of the dental set up, as the patient's saliva mixed with blood, pus, plaque and crevicular fluid is often aerosolized and spattered, thus exposing the dental professional to potential infectious agents like HIV, HBV, herpes, etc. Dentist must be aware of the infection control protocol and mandatorily follow them in his dental set-up. This review article highlights the various infection control protocols to be followed in dental settings which include the different practices of sterilization, surface disinfection, personal protection and waste segregation.

Keywords: Infection control, sterilization, surface disinfection, personal protection

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INTRODUCTION :

Infection control is one of the cornerstones of modern dentistry. It is extremely important not to risk the transmission of any disease. All materials and conditions must be free of bacteria to ensure low risk to patient, the dentist, and the auxiliary personnel.

By definition, infection control is the discipline concerned with preventing nosocomial or health care associated infection.[1] It refers to procedures and activities which aim to prevent or minimise the risk of transmission of infectious diseases.

In this review article, the practices of sterilization, disinfection, personal protection and waste segregation, are discussed for the dental personnel who are at risk of being exposed to infectious materials like body fluids and contaminated equipments, environmental surfaces, water and air. The various infection control practices, if followed, can reduce the potential for cross contamination, i.e., disease transmission from patient to dental professional, from dental professional to patient, and from patient to patient, via the various routes of disease transmission.

The most common routes of disease transmission are:[2]

a) Direct contact (e.g. blood)
b) Indirect contact (e.g. instruments)
c) Contact of oral mucosa with droplets generated from an infected person (e.g. by coughing, sneezing, or talking);
d) Inhalation

Following are the most common and simple preventive practices to be followed by the dental personnel in a routine dental practice.

PERSONAL PROTECTION

Dental team professionals must adapt a series of precautions in order to avoid the various infections to which they are exposed. Education emphasizing the importance of sensibility in this subject undoubtedly is the first and the most important step.

.A set of precautions called universal/standard precautions is designed to prevent transmission of HIV, HBV, and other blood-borne pathogens when providing first aid or health care. According to Centers for Disease Control & Prevention, all patients must be treated as potentially infectious and it involves use of protective barriers & precautions to prevent injuries caused by sharp instruments. The principles of standard precautions include: a) Hand washing b) Use of protective barriers i.e. the use, of personal protective clothing c) Biomedical waste segregation at the time of generation and not after completion of the procedure d) No recapping of needles e) Effective cleaning, decontamination and sterilization of equipments, instruments and environment f) Timely management of spillages g) Use of appropriate disinfectants at the correct working dilution.[3]

Patient evaluation

A thorough medical history should be taken from each patient and updated at each recall visit. While taking a history, the practitioners should identify the infectious diseases of concern, and relevant questions should be asked to disclose sensitive personal information and identify patients who are either particularly susceptible to infection or who are at risk of transmitting infection, known as carriers of disease or by being in a high-risk category.[4]

Patients should be asked whether he/she has been tested positively for following: AIDS, herpes, hepatitis A, hepatitis B, respiratory illness, etc.; also whether he/she lost 10 pounds in last 6 months without dieting; has he/she undergone any blood transfusion before 1985; and whether any recurrent sores in mouth or other parts are present.

HAND HYGIENE

Fingers are the most common vehicles of infection transmission, hence, hand hygiene of all staff members who are either directly or indirectly in contact with patients should be scrupulous.[5] Hand washing is done at the beginning of the clinical session and soon after removal of gloves. Hands are washed with water and an antimicrobial soap (having chlorhexidine gluconate (CHG) at 0.75% to 4% concentration that may be dispensed as liquid soap or foam, parachlorometaxylenol (PCMX) liquid, iodine liquid or triclosan liquid, gel or foam)

After handwashing, any cuts and bruises, if present should be medicated and covered using a band aid/dressing.

Scrubbing hands all the way up to the elbow for about 2 to 6 minutes using a single-use disposable sponge or a soft scrub brush removes the dead cells along with the bacteria resident on the skin of the hands.

Steps in handwashing:[6]

- Wet hands completely with warm water. Extremely hot or cold water should be avoided, as temperature extremes may increase the risk of dermatitis.
- Rub hands together thoroughly for at least 15 seconds, making sure to cover all surfaces of the hands and fingers.
- Rinse hands thoroughly.
- Dry hands thoroughly.
- Turn off manual faucets using a disposable towel to prevent recontamination of hand.

A clean sink should be provided for hand washing, and the taps should be elbow, foot, or sensor operated-. Keep finger nails short and clean. Jewellery should be removed as they tend to entrap organisms and damage gloves.[7]

PERSONAL PROTECTIVE EQUIPMENT (PPE)

These are used to protect personnel from blood and body fluids and chemical hazards, to control cross contamination and prevent spread of microbes. Barrier protection includes use of gloves, eye shields, face masks and rubber dam isolation. OSHA regulations specify that all clinical personnel must wear treatment gloves during all treatment procedures. Gloves must meet the new Food and Drug Administration (FDA) regulation: less than 4 per 100 can have a leak detectable by a water test.[8]

Protective eyewear may consist of goggles, or glasses with solid side shields which protect the eyes from droplets or aerosols. Face masks prevent splatter from patient's mouth or splashes of contaminated solutions of chemicals.

IMMUNIZATION

Hepatitis B virus (HBV) infection is a well-recognized occupational risk for health care professional (HCP) including dental professionals.[9] Immunization is the choice to prevent HBV infections in dental settings. Immunizations substantially reduce both the number of dental professionals susceptible to these diseases and the potential for disease transmission to

other dental professionals and patients. Thus, immunizations are an essential part of prevention and infection-control programs for dental professionals, and a comprehensive immunization policy should be implemented for all dental health-care facilities. The schedule for immunization is three doses of 0, 1 and 6 months and a booster dose after every 5 years.

STERILIZATION AND DISINFECTION

Patient-care items (dental instruments, devices, and equipment) should be categorized as critical, semi-critical, or noncritical, depending on the potential risk for infection associated with their intended use, according to Spaulding.[10] Accordingly the proper procedures for sterilization and disinfection should be selected. Various physical and chemical methods of sterilization are available such as dry heat sterilization (flaming, incineration, hot air oven), moist heat sterilization (pasteurisation, boiling, autoclaving), glass bead sterilization, radiation sterilization, filtration, sonic and ultrasonic sterilization, ethylene oxide sterilization, etc. The killing effect of dry heat is due to the protein denaturation, oxidative damage and the toxic effects of the elevated levels of electrolytes. The principle of autoclave is that when water boils, its vapour pressure equals that of the surrounding atmosphere. Hence, when pressure inside a closed vessel increases, the temperature at which water boils also increases. All surgical instruments can be sterilized using this method. Saturated steam (steam in thermal equilibrium with water from which it is derived) has penetrative power and acts as an effective sterilizing agent. Steam for sterilization can be either wet saturated steam (containing entrained water droplets) or dry saturated steam (no entrained water droplets). Steam comes into contact with cooler surface and condenses to give up its latent heat.[11]

Before sterilization, the contaminated instruments should undergo grouping, pre-soaking, pre-sterilization cleaning, drying, proper sealing and packaging. The biological indicators (eg:- spore strips of Bacillus stearothermophillus) must be checked for every sterilization cycle, if not at least once in a week with physical and chemical methods of monitoring of sterilization cycles.

Items that cannot be sterilized by heat or by other chemical methods (examples — impression materials, casts, and some mirrors used in intraoral photography) are disinfected by immersion method, in which the bioburden is rinsed out, the material is immersed in a disinfectant(eg:- glutaraldehyde, chlorine dioxide, bleach), and the disinfectant is washed off.

Surfaces that cannot be immersed such as bracket table, light handles, hoses, counter surfaces, chair controls, x-ray unit head/handles/controls and other surfaces are disinfected by spraying the disinfectant on the surface, followed by wiping the disinfectant, spraying again and finally after the prescribed disinfection time, the excess is wiped off.

SURFACE BARRIERS

On surfaces difficult to clean and disinfectant (dental light handles, air-water syringe buttons, electrical toggle switches, headrest etc.), barriers such as materials impervious to moisture (eg: - thin plastic wraps, paper, aluminium foils) should be placed. They should be removed and replaced between patients.[12]

DENTAL UNIT WATER CONTAMINATION CONTROL –

Most modern dental unit water systems are made up of a complex maze of waterlines, control blocks, valves, barbs and connectors that are of various sizes and composed of different metals, plastics and rubbers.

The design of all dental unit water systems allows settling of contaminants from water and air. Contaminants can be inorganic materials such as salts from the hardness of the source water that coat the lines and cause corrosion of metals and allow settling of microbes.

MEASURES TO CONTROL WATER CONTAMINATION:

- Flush water lines at the beginning of the day for 30 seconds.
- Flush for several minutes between patients to remove contaminants that can enter the water system during patient treatment.
- In general, disinfectants are allowed to remain in the lines overnight, and are then flushed from the lines the next morning.
- If bleach is used, it should be left in the tubing for a short time only, and the system should then be rinsed with copious amounts of water and left to dry overnight.
- Disinfectants for dental unit waterlines include hydrogen peroxide, chlorhexidine gluconate, and iodophors.[13]

MANAGEMENT OF EXPOSURE TO BLOOD & BODY FLUIDS :

Strategies for decontaminating spills of blood and other body fluids differ by setting and volume of the spill. The person assigned to clean the spill should wear gloves and other PPE as needed.

Nonporous surfaces should be cleaned and then decontaminated with a hospital disinfectant such as 1:100 dilution of sodium hypochlorite (approximately ¼ cup of 5.25% household chlorine bleach to 1 gallon of water) which is an inexpensive and effective disinfecting agent.

MANAGEMENT OF SHARPS –

Inappropriate handling of sharps, both during and after

COLOUR CODING	TYPE OF CONTAINER	WASTE CATEGORY	TREATMENT OPTIONS
YELLOW	Plastic bag	Human anatomical wastes, animal waste, microbiology and bio - technology wastes and solid wastes	Incineration/deep burial
RED	Plastic bag/disinfected container	Microbiology and bio - technology wastes and solid wastes	Autoclaving/microwave/chemical treatment
BLUE/WHITE TRANSLUCENT	Plastic bag/puncture proof container	Waste sharps and solid wastes	Autoclaving/microwave/chemical treatment/shredding
BLACK	Plastic bag	Discarded medicines, incineration ash and chemicals used in production of biologicals	Disposal in secured landfill

treatment, is the major cause of penetrating injuries which involve potential exposure to blood-borne diseases in the dental surgery. Sharp instruments such as scalpels and scalers must never be passed by hand between dental staff members and must be placed in a puncture-resistant tray or bowl after each use.

Needles must not be re-sheathed unless an approved recapping device or single-handed technique is used. Contaminated needles must never be bent or broken by hand or removed from disposable syringes. After use, the contaminated syringe with needle is inserted in the destroyer which generates a high temperature above 1600ÚC, thereby completely burning the needle and reducing it to ashes in just two seconds.

WASTE SEGREGATION AND MANAGEMENT –

Biomedical waste is defined as any solid or liquid waste arising from health care or health related facilities. Categories of biomedical waste include: a. Non- infectious (waste not contaminated with body fluids) b. Infectious waste: (waste contaminated with body fluids and hazardous to others).[9]

All waste generated in dental practice must be segregated into one or other of these categories and disposed off appropriately.[7]

Waste is segregated and colour coded .

CONTAINER AND COLOUR CODING FOR SEGREGATING WASTE [Table 1]

- Black - Non infectious materials
- Yellow - Potentially infectious materials
- White - rigid and puncture proof sharps.
- Red – infected dressings, blood and body fluids.

All segregated waste should be packed in proper containers with red labels monitoring details of biomedical waste and biohazard sign.

CONCLUSION

The huge number of dental professionals working in the field of oral care is prone to various infections like hepatitis, human immunodeficiency viruses (HIV) etc. while taking care of the patients. This enhances the need to follow the basic infection prevention practices so as to avoid the infections amongst themselves and between the patients. Each and every dental examination and procedure should be defined step wise and adhered to strictly guarding both dentist and patient.

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Role of occlusion in restorative dentistry

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ABSTRACT:

Dental occlusion is much more than the physical contact of the biting surface of opposing teeth or their replacements. The materials used in conjunction with restorative dentistry have been changing over the years. Considerable information has been made available concerning their physical and mechanical characteristics. However, factors concerning their effect on occlusion and equilibrium of teeth have not received equal attention. This review is an attempt to provide a basic knowledge of occlusion, as required for the successful placement of the smallest to the largest restoration.

Key words: Occlusion, restorative dentistry, direct restoration, indirect restoration

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Introduction:

The basic objective of restorative dentistry is to develop the form, function and esthetics of the teeth to be in harmony with the stomatognathic system.[1] Occlusion is comprehensively defined biologically as the coordinated functional interaction between the various cell populations forming the masticatory system as they differentiate, model, remodel, fail and repair.[2]

This review is an attempt to provide a basic knowledge of occlusion and its significance in restorative dentistry.

FEATURES TO BE ACHIEVED IN AN OCCLUDING RESTORATION

All features of optimal occlusion should be achieved. Any interfering tooth parts should be eliminated. Incline contacts of occlusion should not be present in restored teeth in order to avoid *'skids'* or eccentric movements of mandible when closing at intercuspal contact position.[3]

The vertical dimension of occlusion should be maintained. The contacts of the cusps should be kept broad if the holding cusps occlude with more than one opposing tooth to prevent movement of the opposing teeth in a non-axial direction by the holding cusps.[4]

Disclusion should occur starting posteriorly and ending by canine disclusion. Posterior disclusion should be achieved in protrusive movements.[4] The features in a restoration must in

most cases conform to the pre-operative occlusion.

NEED FOR RESTORING NORMAL OR PRE-EXISTING OCCLUSION

Occlusion can be static and dynamic. The types of occlusal schemes are mutual protected occlusion, group function and balanced occlusion. New restorations should not introduce any premature contacts and cuspal interferences. Each tooth is to be restored to pre existing physiologic occlusion or to an ideal occlusion so as "to achieve optimum functions of the neuromusculature, joints, and the supporting structures of the teeth."[6]

Correct relationship with adjacent and opposing teeth and buccolingual contour gives the best support against masticatory stresses, prevents food impaction, promotes deflection of food through the embrasures and prevent deflective occlusal contacts. The pulp of the tooth is very sensitive and reacts immediately to abnormal occlusal forces. Hence, occlusion should not be detrimental to pulp.[5]

OCCLUSAL ANALYSIS – PRE TREATMENT EVALUATION

The diagnostic process begins with careful history taking followed by a screening examination.

Questionnaire:

- Is it difficult or painful to open the mouth?
- Is it difficult or painful to chew, talk or use the jaws?
- Do the jaw joints make noises?
- Do the jaws often feel stiff or tired?
- Do you have pain in the ears, temples or cheeks?
- Are headaches, neck aches or tooth aches frequent?
- Does your bite feel unusual or uncomfortable?
- Has there been any recent injury and changes in bite?
- Have you ever had arthritis?
- Has there been any previous treatment for joint pain?
- History of oral habits

EXAMINATION

It has become customary by most dentists to provide the restoration and "check" the occlusion afterwards, with no answer to what the occlusion of the restoration is being checked against. It cannot be the pre existing occlusion if it were not examined first. Hence, a pre operative analysis of occlusion is essential prior to any restoration.[5]

The examination should include extra oral components- muscles, mandibular movements, TMJ, and intra oral component- dentition. [7]

TREATMENT PLANNING – CONFORMATIVE OR RE-ORGANISED APPROACH

Treatment planning is to be followed by diagnosis, which includes occlusal analysis, radiographic examination and diagnostic casts.

Conformative approach: The provision of restorations 'in harmony with the existing jaw relationships'. This is indicated when patient has an ideal occlusion, changing the occlusal surface does not significantly affect the patient's centric occlusion, number of teeth to be restored is less than six, posterior occlusion is stable, and there is no existing mandibular dysfunction.[8]

Reorganized approach- "The provision of new restorations to a different occlusion which is defined *before* the work is started: i.e. 'to visualize the end before starting'. This is indicated when restoration involves teeth with deflecting contacts, multiple restorations, full mouth rehabilitation, reduced vertical dimension, significant change in appearance is desired, fracture of existing restorations or teeth, and presence of mandibular dysfunction.[9]

FORMULATION OF OPTIMAL RESTORATIONS

INDIRECT RESTORATIONS:

The occlusal surface of indirect restorations is fabricated in wax with great accuracy. This may be achieved by addition of wax incrementally (wax dative technique), carving a wax mass to the restoration shape (carve down/ negative carving technique), direct wax pattern (intraoral), or anatomic core wax pattern.[10]

Supporting cusp to marginal ridge relationship is followed in all except the mesiopalatal cusps of maxillary molars and distobuccal cusps of mandibular molars that contact opposing central fossae. Restorations may be carved to duplicate this form. (Figure 1).

Tripodised contact may be created with the supporting cusps contacting the inclines of the triangular ridges as they converge into the central or triangular fossae. (Figure 2).

Occlusal contacts in wax should be verified prior to casting with the use of powder and thin cellophane strips. Once the restoration has been accurately cast, it may be tried in extra orally and intraorally before adjustment.

DIRECT RESTORATIONS

Prior to cutting a tooth, its opposing occlusal surfaces should be examined. Malpositioned opposing supporting cusps, ridges or fossae must be recontoured to achieve optimal occlusal contacts in the restored tooth. Plunger cusps and over-erupted teeth may be reduced and any premature contacts or cuspal interferences may be eliminated.[11] For the proper reproduction of ideal contacts and contours of teeth, two operative acts must

precede or accompany the restorative procedure- tooth movement and matricing.

In amalgam, establishment of a single point contact at the fossa is recommended as a practical alternative to tripodisation as inadvertent removal of any one of the three tripod contacts will result in occlusal instability.[12] When the entire tooth is to be built up in amalgam, there are no enamel planes to guide carving. The restoration may be contoured by referring to outer buccal and lingual contours of the teeth on either side of the restoration.[14] The restoration is tested in centric and excursive movements with articulating papers. The marginal ridges, central fossae, developmental and supplemental grooves may be refined after occlusion has been adjusted.[13]

In case of tooth colored restorations, the approximate anatomy is built up with the material and then reduced and occlusion adjusted using burs. In restoring anterior teeth, they are built/contoured taking adjacent/similar contralateral tooth as a guide and existing incisal guidance must be restored.[14]

OCCLUSION AND RESTORATIVE MATERIALS

The relationship between occlusion and restorative materials is mainly dictated by the wear of teeth or restorative materials. The other factors include occlusal forces, the type of guidance, presence of parafunctional movements, available crown length.

Amalgam: The wear rate of amalgam is only slightly more than enamel and has no appreciable effect on the function of occlusion. Hence, these are preferred in areas of heavier occlusal forces and in patients with parafunction.[17] It was noted in a clinical comparison of amalgam and composite restorations at three years that only 5%- 10% of amalgam restorations lost their anatomic form compared to composite restorations (60% - 70%). [15]

Composite resin: They showed a wear rate 2.5 – 3 times the adjacent areas. They have very low abrasive resistance compared to enamel. In some cases it was found that opposing tooth had supraerupted to maintain function with worn composites. Also, in time, contact areas of class II composites were found to be substantially flattened due to wear, resulting in shifting of adjacent teeth thus altering occlusion. Some currently available systems exhibit wear rates nearly the same as amalgam. Extent of wear depends on size and hardness of the filler particles. The microfill is least abrasive followed by barium silicate glasses and finally quartz filled posterior composite resins. Larger the particle size, greater is the degree of wear.[18] Also, it was found that 'Heat treatment' of resin inlays and onlays reduced wear. Decreased proximal wear was noted when resin was dry heated at 125°C for 5 minutes after first curing by light than those that were light cured only.

Porcelain: They have great potential for abrading the antagonist material or tooth due to hard quartz particles in the feldspathic matrix. Improper occlusion with porcelain coincidentally generates a clicking type of sound whenever the opposing teeth contacted prematurely. They cause uneven wear of teeth resulting in loss of occlusal stability. Occlusal interferences associated with posterior porcelain restorations can also trigger bruxism. The use of porcelain for maxillary anterior teeth is generally contraindicated in cases of limited canine guidance, decreased overjet and increased overbite, when teeth are thin in labiolingual direction and when there is evidence of bruxism. Patients with porcelain occlusals require careful regular monitoring for occlusal imbalances and excessive wear.[16]

Polymeric Resin: Polymeric teeth are considerably less wear resistant. Small occlusal interferences are eventually neutralized or eradicated through normal function. [17]

Base metal alloys: The difficulty of developing functional harmony and their extreme hardness make the base metal

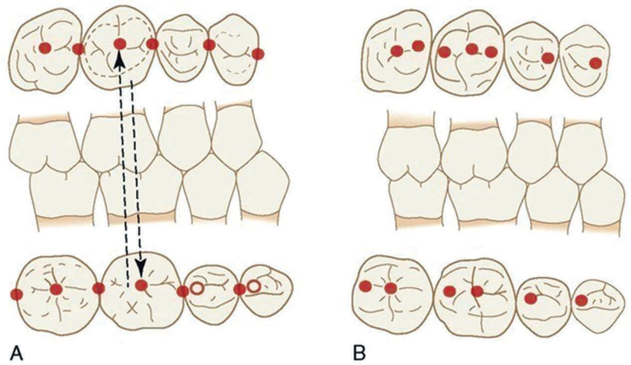

Figure 1: Movement of maxillary supporting cusp across opposing mandibular teeth

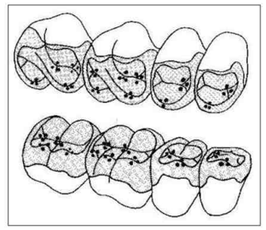

Figure 2: Tripodised contact

alloys often the cause of trauma from occlusion. It is difficult to adjust the occlusion on stainless steel crowns and their removal may be necessary when interferences are more than minimal. In cases where considerable amount of effort is required for establishing and maintaining occlusion (such as in cases of bruxism), gold or palladium based cast alloys are materials of choice because they exhibit similar mechanical properties. It is found that relative wear rate of 'like' restorative materials opposing each other is less than the total wear of different combinations and hence like materials should oppose each other where possible.[17]

An appropriate concept of occlusion and restorative dentistry must reflect an increasing awareness of the procedures which not only contribute to clinical convenience, but also addresses the question of providing an optimal state of health for the life time of the patient. These goals can only be accomplished by relating restorations to the total masticatory system and the psychologic needs of the patient.

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REVIEW

Oral pyogenic granuloma: A Misnomer

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ABSTRACT:

Pyogenic granuloma (PG) is a kind of an inflammatory hyperplasia which is common amongst the oral pathologies .A variety of names are present for the lesion based on its etiopathogenesis and histopathological perspectives. Overtime concepts kept refining with intense research and finally concluded the term "Pyogenic granuloma" as a misnomer since neither the lesion consist of pus nor it is histopathologically representing a granuloma. The etiology of the lesion is still a debate and so is the conflicting opinion on its name per se. Treatment of choice followed is usually conservative surgical excision but other treatment adjuncts are also discussed in this review. All together this review highlights the various aspects of PG which includeetiopathogenesis, clinical, radiological, histopathological presentations and other investigations using immunohistochemistry markers along with new treatment modalities based on scientific evidences.

Keywords: Review, Pyogenic granuloma, misnomer, etiopathogenesis

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INTRODUCTION

Pyogenic granuloma (PG) is the most common entity responsible for soft tissue enlargements and is a kind of inflammatory hyperplasia which means to describe lesions with broad range of nodular growths in oral mucosa along with histological component representing fibrous and granulation counterparts.[1,2] PG is the commonest non-neoplastic tumour of skin and rarely occurs in gastrointestinal tract except for oral mucosa in which incidence is found high among keratinized tissue.[3, 4, 5]History of discovery of pyogenic granuloma hails back in 1897 by Poncet and Dor and then was it named "botryomycosis hominis".[2]The literature search points to the fact that "Pyogenic granuloma" got its present name by Crocker in 1903. However some researchers believe that term pyogenic granuloma or granuloma pyogenicum was introduced initiallyby Hartzell in 1904.[6] The incidence of Oral Pyogenic granuloma was found around 1.85% of all oral pathologies as per Bhaskar et al. in a study done at US Army Institute of Dental Research.[1]Cawson et al. states that pyogenic granuloma is a

common lesion and represents 0.5% of all skin nodules and pregnancy tumour a variant occurs upto 5% in all pregnancies.[7] Oral pyogenic granuloma was found to be the most frequent non-neoplastic lesion according to study by Shamim et al accounting to nearly 52.7% of the lesions. [8]Therefore epidemiologic insights projects that this lesion is frequent among oral pathologies in general.

Why a misnomer?

A misnomer is a word or term that suggests a meaning that is known to be wrong. They often arise before the true nature was unknown or because the nature of an earlier form is no longer a norm. As the Latin word "etymon nominare" means "to name"; a misnomermeans a special kind of mistake or misapplied or wrong name. [9] There were different terminologies put forward to this lesion starting from the earliest "botryomycosis hominis" and also includegranuloma pediculatum benignum, granuloma telangiectactium, benign vascular tumor, pregnancy tumor, vascular epulis and Crocker and Hartzell disease as others. The lesion was subjected toan array of names from past to present based on the etiology and histopathological perspectives. Over time these concepts kept refining with more researches in this area and finally concluded; *"Pyogenic Granuloma*" as a misnomer since neither the lesion containpus nordoes it represent a granuloma histopathologically. [1, 10,11]

Theories of Etiopathogenesis: Past to Present

Some investigators regard pyogenic granuloma as "infectious" in origin. Staphylococcus and botryomycosis, foreign bodies and localization of infection in blood vessel walls were projected as factors of development of the lesion.Shafer et al. suggested that either staphylococci or streptococci could produce colonies with fungus like characteristics and oral pyogenic granuloma arises as a result of these infection.[12] As per Reichart et al. granulation tissue in the lesion gets contaminated by flora of the oral cavity and the surface gets covered with fibrin which mimic pus.[13]However suppuration is not a characteristic feature of oral pyogenic granuloma to support infectious origin and also in the inclusion of term "pyo" in name of the lesion. Majority of the studies has pointed out that even though the lesion has been associated to certain species of Bartonella henselea species and Human herpes virus type 8 in certain recurrent lesions; there is no evidence confirming the presence of these microorganisms in larger groups of pyogenic granuloma lesions.[14] Currently etiopathogenesis suggests that the lesion is result of some minor trauma to tissues which provides pathway for invasion of microscopic non-specific organisms.[12]

Studies also stated that after any trauma wound healing is initiated with formation of granulation tissue. The process of wound healing is controlled by various cytokines which include growth factors mainly basic fibroblast growth factor, an angiogenic heparin binding angioprotein which is mitogenic for capillary endothelial cells. Certain growth factors such as inducible nitric oxide synthetase, vascular endothelial growth factor, basic fibroblast growth factor or connective tissue growth factor had integral roles in angiogenesis and rapid growth of PG.[15]

Researchers also considered pyogenic granuloma as a "reactive" or "reparative" lesion. Regezi et al. has suggested that pyogenic granuloma is an exuberant connective tissue proliferation to a known stimulus or injury which includes calculus or foreign materials within gingival crevice. The reactive process can be to various stimuli which include chronic low grade local irritation, trauma, hormonal factors or certain kinds of drugs.[16]

Richardson and Krotochovil suggested that hormonal influence play basis in incidence of pregnancy tumour, which is a variant of the lesion. Current studies have revealed the effect of sex hormones which manifest a variety of biological and immunological process. [17] Estrogen increases vascular endothelial growth factor (VEGF) production in macrophages which is related to the development of lesion in pregnancy. This effect is also seen antagonized by the androgens. Study by Yuan et al. suggested increased levels of VEGF and basic fibroblast growth factor expressions in pyogenic granuloma lesions. Studies have proposed that in the absence of VEGF, Angiopoetin -2 (Ang-2) causes the blood vessels to regress and their levels were seen regulated by Tumor necrosis factor alpha in all endothelial cells. It was seen that amount of VEGF was high in granulomas of pregnancy and was absent or undetectable after parturition. After parturition more of apoptic cells and less of Ang-2 are seen expressed compared to pregnancy. Therefore VEGF alone or in combination with Ang-2 could be beneficial in protecting blood vessels from apoptosis.[18] Progesterone acts as an immunosuppressant in gingival tissues in pregnancy as per study by Harri et al. preventing rapid acute inflammatory reaction against plaque, but allowing chronic tissue reaction resulting in exuberant proliferation due to inflammation.[19] However oral contraceptives influence on vascular changes in periodontium is still unclear due to absence of steroid receptors in the periodontium as per findings by Nichols et al. which suggest that estrogen or progesterone are not directly involved in formation of the lesion.[20]

Drugs like cyclosporine was seen to have a role in development of the lesion in patients who were given the drug for graft versus host disease. [21]Inclusion bodies were found in the

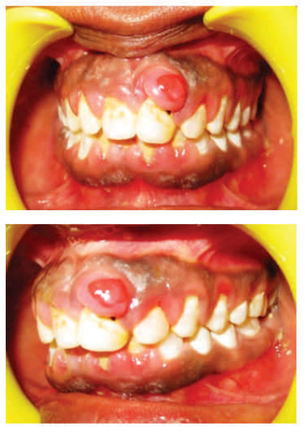
fibroblasts of the lesion suggestive of disordered protein metabolism according to the Davies et al.[22]

Growth rate of the tumour is not only seen related to proliferative activity of tumour cells but is also seen related to the rate of cell death. Studies have suggested low apoptotic rate in PG which is related to growth rate and regulation by Bcl2 family proteins.[23]

Clinical Presentations

Oral Pyogenic granuloma is the most common gingival tumour, with predeliction for gingiva in 75% of all cases. Extragingival lesions involve lips, tongue, buccal mucosa and hard palate. Lesions are common in maxillary gingiva and have predeliction towards anterior region than posterior counterparts. These lesions are much common on the facial aspect of the gingiva than the lingual aspect with some extending between teeth and both facial and lingual gingiva. Although PG occur at all age groups; highest incidence was seen in second and fifth decades and females were slightly more affected than males. Predeliction in second decade among young females was possibly related to the vascular effects of female sex hormones.[1, 2, 10,16]

Clinical presentation of the lesion manifests from smooth or exophytic small, red erythematous papule on a pedunculated base or sessile, usually compressible and haemorrhagic. Size varies from few millimetres to several centimetres rarely exceeding 2.5cm in size.[11] The clinical development of the lesion starts slow, asymptomatic and painless but at times grow rapidly. The surface is sometimes ulcerated which may be covered with yellow fibrinous membrane. The colour ranges from pink to red purple depending upon the age of the lesion



Pyogenic granuloma: A Clinical presentation

with younger PG's appearing more reddish because of the capillary predominance present in the hyperplastic granulation tissue. Older lesions on the other hand are more collegenized and therefore appear pink.[2, 10]

Pregnancy tumour a variant of PG appears normally in the second – third month of pregnancy, with a tendency to bleed and possibility of interaction while masticating food. In the initial months of pregnancy, the plaque influence persistently producing catarrhal inflammation of gingiva that serve a base for development of hyperplasia of the gingival tissue where as in the last trimester modulation is mainly by the circulating hormonal stimuli.[24]

Radiological Presentations

The relevant radiological findings are usually absent in pyogenic granuloma. In rare instances; long standing gingival lesionsthere is someloss of the alveolar crest where the epulis find attachment or it might produce saucer shape excavation of variable depth[10,12 25]

HistopathologicalPresentations

Briefly the natural history of the lesion follows three distinct phases.[26]

***Initial/Cellular phase* -** Consist of lobules which are compact and cellular with little lumen formation.

***Capillary phase* -** The lobules becomes vascular with abundant intraluminal red blood cells. One or more central vessels form large lumen with thick muscular layer bearing resemblance to veins.

***Late/Involutionary phase* –** Increased tendencyfor intra and perilobular fibrosis with increased venular differentiation.

Two distinct histological patterns of PG exist which include lobular capillary hemangioma type and non –lobular type. The first type is characterised by proliferating blood vessels that are arranged in lobular pattern although superficially lesion does not undergo specific changes like edema, capillary dilation or inflammatory granulation tissue reaction.[27] The latter non –lobular type consists of highly vascular proliferation that resembles granulation tissue with the central area consisting significantly increased number of vessels with perivascular mesenchymal cells non-reactive to alpha smooth muscle actin and muscle specific actin than its lobular type counterpart. Even though PG can undergo fibrous maturation over time; it is suggested that it happened only in non-lobular capillary haemangioma type of lesion clearly indicating different pathways of evolution amongst the two types of PG.[10, 11]

Other Investigations: IHCMarkers

Increased expression of basic fibroblast growth factor,Tie-2, anti –CD34 and anti-alpha SMA antibodies, vascular

morphogenesis factors such as Angiopoetin -1, Angiopoetin -2, Ephrin B2 and B4 respectively were seen evident in PG lesions. Also low apoptotic rate expression of Bax/Bcl-2 proteins and strong expression of phosphorylated mitogen activated protein kinase and increased expression on vascular endothelial growth factor (VEGF) were alsoseen significantly evident.[23,28]

Differential Diagnosis

Differential diagnosis is helpful in further evaluation and management of the patient. The differential diagnosis of PG lesions include peripheral giant cell granuloma, peripheral ossifying fibroma, peripheral odontogenic fibroma, hemangioma, conventional granulation tissue, hyperplastic gingival inflammation, Kaposi's sarcoma, Bacillary angiomatosis, angiosarcoma and non-Hodgkin's Lymphoma.[13,29]

TREATMENT

Excisional biopsy is indicated treatment of PG, except when procedure would produce marked deformity where incisional biopsy becomes mandatory line of investigation. Therefore management depends on the severity of symptoms.[30] The usual treatment option include conservative surgical excision and removal of causal irritants like plaque, calculus, foreign materials, source of trauma etc.[2,10]Excision with 2mm margins from its clinical periphery and to depth of periosteum or to causative agent was recommended. [31]Recently other treatment protocols using lasers have been proposed because of the lower risk of bleeding compared to other surgical techniques. Nd: YAG lasers were superior to C02 lasers because of its superior coagulation properties.[32, 33] Other treatment modalities for management of the lesion includes cryosurgery. Oral mucosa because of its humidity and smoothness was seen ideal for cryosurgery technique. [34] Sclerotherapy with intralesional injections using sodium tetradecyl sulphate, absolute ethanol etc were seen to be other alternative treatment adjuncts used in practice because of its simplicity and lack of scarring quality but require multiple treatment sessions.[35,36] Recurrence rate after surgical excision ranged from 5.8% to 15.8% of PG cases.[2,37] Gingival lesions had higher recurrence rate compared to other oral mucosal sites and showed no infiltrative or malignant potential.

CONCLUSION

Oral PG is one among the commonest of all oral pathologies. The etiopathogenesis of the lesion is still debatable and so is its "name" making it different from the other oral lesions.This article helps to highlight on various aspects of the oral pyogenic granuloma based on scientific observations.

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Abraham, *et al.:* Oral pyogenic granuloma

REVIEW

Alveolar ridge augmentation in implant dentistry- Rebuilding a strong foundation

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ABSTRACT:

A severely resorbed alveolar ridge is a challenge in implant dentistry. Ridge resorption occurs following the loss of a tooth and is inevitable. For an implant to be successful both in function as well as esthetically the compromised ridge must be augmented. This review discusses current trends in alveolar ridge augmentation in preparation for dental reconstruction with dental implants.

KEY WORDS : Alveolar ridge, ridge resorption, guided bone regeneration, bone grafts, osseodensification

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INTRODUCTION

Dental rehabilitation of missing teeth by oral implants has shown to yield high predictability[1](97–98%) and satisfactory longevity.[2] In case of severe bone loss, implant placement is really a challenge that has significant impact on success of implants. Among several reasons of alveolar bone loss such as trauma, congenital alveolar defects, pathology, chronic/acute infection, periodontal disease, a tooth extraction and its sequelae is the most commonly encountered scenario that leads to this clinical deficiency.

The atrophy of alveolar ridge after tooth loss follows definite patterns. In the maxilla, the labial wall of the alveolar socket tends to resorb more rapidly than palatal wall following dental extraction (centripetal resorption).[3] In the mandible, however, the lingual wall tends to resorb ahead of the buccal wall (centrifugal resorption). This discrepancy in the resorption pattern will lead to a compromised sagittal and axial intermaxillary relationship.[4] In both the jaws, the width of the ridge is compromised earlier than its height.[5] These discrepancies will lead to difficulties in oral implant placements both in functional as well as esthetic perspective.

DIAGNOSIS AND TREATMENT PLANNING

Patient factors

There are no absolute contraindications for any of the bone augmentation procedures. But patient's systemic status should be considered while the diagnosis and treatment planning is done. Certain systemic conditions such as diabetes mellitus should be taken into consideration which may impair the healing. Histologic evidence of impaired healing was found in implants placed in diabetic animals when compared to healthy controls, even though osseointegration was achieved in both groups.[6] The potential for *de novo* bone formation following guided bone regeneration (GBR) in experimental diabetes and metabolic control was investigated in rat models.[7] No significant difference was found in the amount of vertical bone regeneration when insulin controlled diabetic, uncontrolled diabetic, and healthy animals were compared. But an increased rate of infectious complications was shown by the uncontrolled diabetes group.

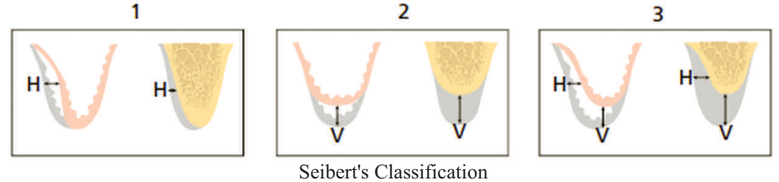
Another factor which should be considered is smoking. It has been found that the long term prognosis of osseointegration is negatively affected by smoking.[8] Smokers are more likely to develop complications such as peri-implant mucositis and peri-implantitis around successfully integrated implants.[9] A systematic review reported higher rates of complications and failures in smokers than non smokers. Also less amount of bone augmentation was seen in smokers when compared with that in non smokers.[10]

Preoperative evaluation of alveolar ridge

The evaluation of the alveolar ridge before intervention should mainly focus on the measurements of ridge dimensions to select appropriate implant size, the location of anatomical landmarks such as maxillary sinus and inferior alveolar canal. In order to decide on the ridge augmentation strategy, the remaining bone crest level is precisely determined using 3D

Classification of ridge defects [11]

Soft/hard tissue defects Seibert (1983)	Class I:bucco-lingual loss of tissue with normal apico-coronal ridge height Class II: apico-coronal loss of tissue with normal bucco-lingual ridge width Class III : combination-type defects (loss of both height and width)
Allen et al	A: apico-coronal loss of tissue B:buccolingual loss of tissue C:combination Mild:< 3 mm;medium:3–6 mm; severe:> 6 mm
Hard tissue defects Lekholm and Zarb	A: virtually intact alveolar ridge B: minor resorption of alveolar ridge C:advanced resorption of alveolar ridge to base of dental arch D: initial resorption of base of dental arch E:extreme resorption of base of dental arch
Misch and Judy	A: abundant bone B: barely sufficient bone C: compromised bone C- h: compromised height; C- w: compromised width D: deficient bone



Seibert's Classification

radiographic methods.

BONE AUGMENTATION THERAPIES

Guided bone regeneration

The treatment concept of GBR is to exclude the soft tissues from filling the osseous defect and allowing the bone forming cells to occupy the defect space. Depending on the type of defect, the space could be maintained by utilizing a block graft or a particulated graft. Different natural and synthetic biomaterials have been developed and used as graft materials in augmentation of ridge defects.

Barrier Memberanes : They are broadly classified into non-resorbable and resorbable.

Expanded polytetraflouroethylene (e-PTFE) is the most frequently used non resorbable membrane. It has a flexible property and external porous structure which allows tissue integration and an internal occlusive layer which functions as a barrier mechanism. A titanium scaffold is added between two layers of e-PTFE to enhance the space making capacity of these devices. But the disadvantage of these devices is that a second intervention is needed to remove them. So in order to overcome this difficulty resorbable membranes were developed. Bioresorbable membranes are either natural (xenogeneic collagen type I or III) or made of synthetic polymers, including polyurethane, polyglactin 910, polylactic acid, polyglycolic acid, polyorthoester, polyethylene glycol, and different combinations of polylactic and polyglycolic acid.

Bioresorbable membranes when placed directly over the implant threads, tend to collapse and occlude the space available for bone regeneration. This problem can be avoided by using a scaffold or graft material under the membrane that provides the space for tissue in growth and subsequent bone formation. When non resorbable and collagen resorbable membranes, with and without the use of a scaffold, were compared in an animal study, similar bone regenerative outcomes was obtained for the non resorbable membranes and the collagen resorbable membranes used with a scaffold.[12]

Thus resorbable membranes are currently considered as the gold standard when used in conjunction with an adequate space-making graft material.

Bone grafts and bone substitutes:

Bone grafts

Autogenous bone grafts are considered as the gold standard in bone regeneration therapies as they have osteoinductive, osteoconductive and osteogenic properties.[13] In alveolar ridge defects, autografts are either used as a particulate or a block graft. Particulate grafts are harvested from intra oral sites and are used along with barrier membranes following the principles of guided bone regeneration. Block grafts are harvested either from intra oral sites or extra oral sites. They are used with barrier membranes or alone but they require fixation to the recipient site with micro screws in order to stabilize the graft while healing.

Allografts are harvested from cadaver and are processed by freezing or demineralization and freezing. It is then sterilized and made available as particulate or as blocks. They are usually used with barrier membranes following principles of GBR.

Xenografts are of animal origin, usually of bovine or porcine. These graft materials are prepared by deproteinizing and thereby avoiding the immunogenic property. These type of graft materials are usually particulate and used according to the principles of GBR.

Bone substitutes

Alloplasts are synthetic biocompatible bone substitutes. Alloplastic material such as ² – tricalcium phosphate which is resorbable is osteoneutral and is totally inert and serves only as space fillers. They include different combinations of calcium phosphates synthesized under different sintering conditions to attain different physical properties and resorption rates. The combination of ² – tricalcium phosphate and hydroxyapatite provides both scaffolding as well as an osteoconductive function. They are usually used as granules and should always be used in conjunction with barrier membranes.

RIDGE AUGMENTATION PROCEDURES

Socket preservation

Socket preservation is a procedure which aims at minimizing alveolar ridge atrophy after tooth extraction. A wide range of socket preservation techniques and materials have been reported that significantly reduce bone loss following extraction. Atraumatic extraction leaving the socket wall intact is enough to regenerate socket bone formation.[14] This procedure utilizes regenerative techniques such as resorbable / non-resorbable membranes, resorbable membranes in conjunction with bone substitutes, bone substitutes alone or bone substitutes in combination with soft tissue grafts.

The subgroup analysis of a systematic review gave the following conclusions: [15]

- Use of membranes gave better results than for use of grafts alone in terms of horizontal bone changes.
- A slight tendency towards less bone loss in the horizontal direction was observed when the sockets healed by primary intention.
- Flapped (primary closure) surgical procedures demonstrated significantly less horizontal bone resorption of the socket, when compared to flapless (healing by secondary intention) surgeries.

Horizontal ridge augmentation

Horizontal ridge augmentation can be done by using either particulate grafts or block grafts, with or without barrier membranes. When there is enough bone width, it is indicated to use particulate grafts together with barrier membranes to allow good implant primary stability.

Both GBR and block grafts have been demonstrated to be a successful and predictable treatment

modality to augment a horizontally deficient ridge.[16] A randomized clinical trial study has revealed that onlay graft group attained more horizontal bone gain than GBR group.[17]

Since the use of autografts is limited due to morbidity while procuring the graft and also the higher resorption rate, bone substitutes, particularly xenografts along with barrier membranes are used and have demonstrated good results.

Ridge splitting & ridge expansion

This is a technique used in the maxilla to augment bone width through bone condensation. Summers first used this technique, osteocondensation, to augment bone width and elevate sinus floors in an attempt to avoid the lateral window sinus lift.

Chisels and osteotomes are used which will cause longitudinal greenstick fractures in the bone and create osteotomy sites without the need for drilling. This preserves the compromised bone volume. The bone is compressed to the lateral surfaces with the use of osteotomes of increasing diameters, thus increasing itsstrength and density. The advantage of this technique is that it allows for the ideal implant diameter to be placed in the restoratively driven position. This procedure is followed by the simultaneous placement of the implant.

Ridge splitting is essentially the fracture of the buccal cortical plate and its displacement laterally to accommodate implant placement. The spaces created between the cortical plates and the implants are subsequently filled with particulate bone graft materials.

Ridge splitting using piezosurgery

In the cortical mandible, bone splitting is much more challenging, as mechanical trauma as well as the shape and design of the cutting tools often fracture the thin and fragile bone segments. In such cases, bone sectioning with piezoelectric devices ensures micrometric osteotomies with no macrovibrations and allows easy handling with an increased maneuverability even in delicate cases.

Vertical ridge augmentation

Various studies during the last decade have reported good results using vertical bone augmentation techniques with bone graft materials, membranes, or both. However, vertical augmentation may be less predictable than horizontal augmentation.

A study in patients with atrophic edentulous ridges it was demonstrated that up to 4 mm of vertical bone augmentation can be predictably regenerated.[18] The surgical protocol included the use of a membrane reinforced with a titanium structure. This membrane can be shaped to maintain the desired form, thereby creating and preserving sufficient space between the membrane and the bone defect.

Alveolar distraction osteogenesis

Distraction osteogenesis surgery is currently available worldwide for managing orthopedic disorders. The process of alveolar distraction osteogenesis involves mobilization, transport, and fixation of a healthy segment of bone adjacent to the deficient or deformed site.

A mechanical alveolar distraction device is used to provide gradual, controlled transport of a mobilized alveolar segment. Distraction is usually performed over a period of 30 days and significant bone gain can be attained (4–7 mm).[19] When the desired repositioning of the bone segment is achieved, the distraction device is left in a static mode to act as a fixation tool. Because the soft tissue is left attached to the transport segment, the movement of the bone also results in expansion of soft tissue adjacent to the bone segment. As a result of the distraction process, the volume of bone and soft tissue increases. The reconstructed site is then suitable for further rehabilitation with osseointegrated implants.

However, distraction osteogenesis has frequent complications, such as fracture of the mandible or the moveable segment, patient discomfort etc.

Molecular approach in bone augmentation

The use of growth factors has received more attention for treatment of deficient alveolar ridges. Advances in molecular cloning have made available unlimited quantities of recombinant growth factors for applications in tissue engineering. Recombinant growth factors such as platelet derived growth factors (PDGF),insulin like growth factors (IGFs), fibroblast growth factors (FGFs),and bone morphogenetic proteins (BMP)'s have been used in clinical trials for the treatment of large ridge and alveolar deficiencies. [20,21]

In vivo application of PDGF alone or in combination with IGF 1 enhances mineralized tissue repair.[22],[23] PDGF also has been shown to have a significant regenerative impact on periodontal ligament cells as well as on osteoblasts.[24,25]

Bone morphogenetic proteins (BMP) are a group of regulatory glycoproteins that are members of the TGFα superfamily. Investigations in animal models have shown the potential repair of alveolar bony defects using rhBMP 12.[26] In a clinical trial, rhBMP 2 delivered by a bioresorbable collagen sponge revealed significant bone formation in a human buccal wall defect model following tooth extraction when compared to the collagen sponge alone.[27] Also BMP 7, stimulates bone regeneration around teeth and endosseous dental implants, and in maxillary sinus floor augmentation procedures.[28]

OSSEODENSIFICATION – a new technique for ridge expansion and enhanced implant stability

Standard drill designs used in dental implantology are made to excavate bone to create room for implant placement. They cut away bone effectively but typically do not produce a precise circumferential osteotomy. Moreover, osteotomies drilled into narrow bone locations may produce dehiscence, buccally or lingually, which also reduces primary stability and will require an additional bone grafting procedure adding cost and healing time to treatment.

Unlike traditional bone drilling technologies, osseodensification does not excavate bone tissue. Also, it preserves bone bulk, so bone tissue is simultaneously compacted and autografted in an outwardly expanding direction to form the osteotomy. It is accomplished by using proprietary densifying burs. When the densifying bur is rotated at high speed in a reversed, non-cutting direction with steady external irrigation (Densifying Mode), a dense compacted layer of bone tissue is formed along the walls and base of the osteotomy.[29]

An *in vivo* study in sheep model compared conventional drilling method as control and osseodensification method as test group.[30] The results revealed that a significant increase of ridge width and bone volume percentage (%BV) (approximately 30% higher) was detected in the test group. Significantly better primary implant stability was achieved in the test group.

Only few studies which have used this new technique are reported. So more clinical trials should be carried out for validating the technique and also for its incorporation in practice of implant dentistry.

BONE AUGMENTATION IN FUTURE

There is a possible impact of tissue engineering on bone regeneration in the future. A more predictable regeneration of bone can be achieved by developing a therapeutic system which can deliver the right cells at the right time in the presence of growth factors. Various novel delivery scaffolding systems are being extensively studied and fabricated, and are demonstrating capabilities to meet the challenges of current regeneration therapy and probably can be used in near future. One such technology that may evolve is 3D printing. Data from computed tomography (CT) and magnetic resonance imaging (MRI) are utilized to produce a 3D printed scaffold which fit exactly into the defect.

CONCLUSION

This review has demonstrated that a wide range of surgical procedures can be used to correct deficient edentulous ridges. However, there are not enough data showing a single surgical procedure which offer a better outcome than another, as far as predictability of the augmentation and survival/success rates of implants placed in augmented sites are concerned. Every surgical procedure presents advantages and disadvantages, which must be carefully evaluated before surgery. Ridge-splitting techniques are mainly used as alternatives for grafting to avoid morbidity and reduce the graft complications. But these techniques are applicable only if there is enough cancellous bone between the two cortices. Distraction osteogenesis allows for more vertical bone augmentation than other techniques. But patient compliance should be assured throughout the treatment period.

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REVIEW

Newer periodontal pathogens and their potential role in Periodontitis

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ABSTRACT:

Periodontitis, a biofilm-associated inflammatory disease of the periodontium, is a major cause of tooth loss in the world. This disease appears to have multiple etiologies, the most studied of which are microbial and immunological causes. Socransky and Haffajee using checkerboard DNA-DNA hybridization gave us clarity into the key microbial players in dental plaque associated biofilm. However researchers have since then found out many other organisms which seem to play an equally important role in the causation of periodontitis, be it adult periodontitis, aggressive periodontitis or refractory periodontitis. This review aims to highlight those newer periodontal pathogens which have been discovered but haven't been given due importance as causative factors of periodontitis. Knowledge about these pathogens may be essential in the future to treat periodontitis in a site specific and patient specific way.

Key words: Newer periodontal pathogens, checkerboard DNA-DNA hybridization, oral synergistetes,

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INTRODUCTION

Periodontitis is a chronic inflammatory disease of the supporting structures of the periodontium thought to be caused by an interplay of microbial invasion and host immune inflammatory response leading to loss of alveolar bone and eventually tooth loss. From the discovery of microbes on tooth surface by Leuwenhoek to the dysbiotic theory by Hajishengallis periodontology has taught us that these organisms are not to be ignored but to be taken very seriously as they are the harbingers of disease entity.

The establishment of a microorganism as a true pathogen should be based on two main levels of evidence: (1) the organism should be present in higher prevalence and/or levels in disease than in health

("association" studies), and (2) its suppression or elimination should reduce or stop disease progression.[1]

HISTORY

The microbial etiology of periodontitis had been established since 1976 when the non-specific plaque hypothesis was proposed by Loesche. Socransky[2] and Haffajee brought greater clarity into the oral microbiota when they grouped organisms into coloured complexes by checkerboard DNA-DNA hybridization.In 2001, using cloning and Sanger sequencing, Paster[3]et alsuggested a possible role of cultivable and not-yet cultivable/unrecognized microbial species in the etiology of periodontitis, confirming the idea that the diversity of the oral microbiota was more complex than previously known. Several molecular approaches, sequencing techniques, were published in the periodontal literature by Kumar[4]et al; Matarazzo[5]et al; Teles[6]et al; Griffen[7]et al and Abusleme[8]et al.Haffajee[9] et al attempted to study the complexes in supragingival plaque adopting cluster analysis and community ordination.The red complex observed in subgingival plaque was strengthened with the addition of *Eubacteriumno-datum* and *Treponema socranskii.* Similar additions were observed in orange and yellow complex.[9]

Normally pathogenic organisms like *Porphyromona-sgingivalis* and Aggregatibacteractinomycetemcomitans being observed in healthy sites was contrary to specific plaque hypothesis, microbial shift and keystone pathogen hypothesis. The Polymicrobial synergy and dysbiotic[10] theory gives credit to the fact that these organisms can be present even at healthy sites but can elevate the virulence of a community following interactive communication with other pathogens like Streptococcus mitis.

All speculations about different micro-organisms in a biofilm still remain as more microbes get discovered and their interactions with other groups of pathogens still remain unexplored. However too much attention to red complex organisms as being primarily responsible for disease has been paid when hitherto undiscovered microbes may be the real culprits.

Therefore the aim of this review is to shed light on these newer micro-organisms which have been implicated in periodontitis through various studies and which have clinical relevance as etiological agents of periodontitis.

NEW ADDITIONS IN DIFFERENT COMPLEXES:[9]

TREPONEMA SOCRANSKII

A new species, *Treponema socranskii,* and three new subspecies, *T. socranskii* subsp. *socranskii, T. socranskii* subsp. *buccale,* and *T. socranskii* subsp. *paredis,* were isolated from supra gingival and sub gingival samples from patients

Organisms strongly implicated in periodontitis [6,11]	Newer species implicated in the causation of periodontitis [6,11]
Porphyromonas gingivalis	*Filifactora locis*
Tannerella forsythia	*Dialister pneumosintes*
Aggregatibacteractinomycetemcomitans	*Fretibacterium fastidiosum*
Prevotella intermedia	*Jonquetella anthropi*
Prevotella melaninogenica	*Pyramido bacterpiscolens*
Fusobacterium nucleatum	*Solobacterium moorei*
Eikenella corrodens	*Treponema lecithinolyticum*
Prevotella nigrescens	*Parvimona smicra*
Capnocytopha gagingivalis	*Methanobrevi bacteroralis*
Treponema denticola	*Bulleidiaextructa, Slakiaexigua*
Treponema socranskii	*Porphyromona sendodontalis*
Eubacterium nodatum	*Prevotella histicola*
Campylobacter rectus.	*Cryptobacterium curtum.*

with periodontitis and from patients with experimental gingivitis by Smibert et al. These organisms ferment carbohydrates and require rumen fluid or fatty acids for growth. The major products of fermentation are acetic, lactic, and succinic acids.[12]

T. socranskii, T. denticola, and *P. gingivalis* are associated with the severity of periodontal tissue destruction.[13] Later Haffajee et al found this organism in periodontitis patients along with P.gingivalis and T.denticola and suggested addition of this organism into the red complex.[9]According to a systematic review by Rakic et al on the microbiologic profile on peri-implantitis, T.socranskii is a prominent member of peri-implant microbiota.[14]

FILI FACTOR ALOCIS (*filum*, thread; *factor*, a maker; *Filifactor*, thread-maker. *alox -okos*, a furrow; *alocis*, of a furrow, referring to its isolation from a crevice of the gums)[15]

It is a fastidious, gram-positive, obligatory anaerobic rod possessing trypsin-like enzymatic activity similar to *P. gingivalis*and *T. denticola*. This organism has been found in elevated numbers in aggressive periodontitis (77.8%) and chronic periodontitis (76.7%) compared with periodontally healthy individuals due to its potential to withstand oxidative stress and inflammatory microenvironment provided by periodontal pocket.[16]. *Filifactor*is attributed as the second most prevalent in chronic periodontitis and third most prevalent in generalized aggressive periodontitis and proposed to be an excellent marker organism for periodontal disease.[16, 17,18]Moffat[19] et al in examined the responses of primary cultures of gingival epithelial cells (GECs) to infection with F. alocis. Secretion of the pro-inflammatory cytokines IL-1b, IL-6 and TNF-± from GECs was stimulated by F. alocisinfection.

EUBACTERIUM NODATUM

These species are all obligatory anaerobic, asaccharolytic, nonreactive and they grow poorly and slowly on media commonly used to isolate anaerobic bacteria. Three new species, *E. nodatum, Eubacterium timidum*, and *Eubacterium brachy*, were described, primarily from subgingival samples taken from patients with moderate and severe adult periodontitis. Except for the isolation of *E. brachy* from a pleuropulmonary infection, these species have not been reported from other infected body sites.The organism shows cellular and morphological properties of *Actinomyces*sp. *Actinomycesisraelii*.[9,20] Haffajee*et al*. reported higher mean counts, proportions and percentage of sites of *P. gingivalis* and *T. forsythia* as well as *E. nodatum*and*T. denticola*from subjects with periodontitis than from periodontally healthy subjects. Hence they found merit in including *E. nodatum*as a part of the red complex.[20]

DIALISTER PNEUMOSINTES

These are small, gram-negative rod that grows with punctiform, convex, transparent, shiny, smooth colonies on blood agar.[21]D. pneumosintes is a frequent isolate from the oral cavity and has been implicated in periodontitis; closely associated with Tanerella forsythia.With refinements in molecular microbiology especially 16S ribosomal RNA (rRNA) polymerase chain reaction (PCR) identification method, Ghayoumi*et al*. determined the presence of *D. pneumosintes* from periodontal pockets and implicated it as "candidate pathogen."

D.pneumosintes may provide growth factors for T.forsythia or vice versa. D.pneumosintes was detected in 83% of patients having severe periodontitis and in 19% of patients having slight periodontitis. Hence it was suggested to add D. pneumosintes to the group of suspected periodontal pathogens.[21, 22]Cytomegalovirus presence is associated with the presence of this organism.[23, 24]D. pneumosintes was detected in refractory periodontitis by Colombo et al.[25] Higher counts in subgingival plaque of 156 chronic patients and 66 aggressive periodontitis patients by Silva et al.[26] Smokers harbored significantly higher numbers of *D. pneumosintes* associated with moderate and deep pockets.[24,25]

ORALSYNERGISTETES

These include *Fretibacterium fastidiosum, Jonquetella anthropic, Pyramido bacterpiscolens.*[27]Al-hebshi[27] et al in explored associations among classical and new putative pathogens in subgingival biofilm and assessed their relative importance in chronic periodontitis. The log counts of oral Synergistetes were the best marker of periodontitis followed by those of *T. forsythia, P. micra and T. denticola.*

Oral Synergistetes are divided into clusters A and B by Vartoukian et al,[28] A includes species of the new genus Fretibacterium, including F. fastidiosum (Downes J), while cluster B include J. anthropi and P. piscolens. Oral Synergistetes are presented as new members of the red complex, with relative importance to periodontitis exceeding that of the classical members.

SOLOBACTERIUM MOOREI

Named in honor of an American microbiologist Moore[29] it is a gram-positive, non-spore forming, anaerobic bacillus originally isolated from human feces. In the last decade, *S. moorei* has been associated with halitosis and subgingival plaque from patients with refractory periodontitis.

Kazor[29]*et al*. found *S. moorei* in three of six subjects with halitosis and in one of five normal subjects. Haraszthy[30]*et al*. using PCR identified *S. moorei* on the dorsal surface of the

tongue in eight of eightsubjects with halitosis but in zero of five normal subjects. S. moorei strains produce volatile sulfur compounds through a process involving the galactosidase activity of the bacterium and an exogenous source of proteases.[30,31] *S. moorei* is susceptible to the antimicrobial agents' tea tree oil and alpha-bisabolol, suggesting that these compounds might be beneficial in oral healthcare products.[32]

BDELLOVIBRIO BACTERIOVORUS

Bdellovibrio(BALO) are small (0.25× 1.0 µm), flagellate gram-negative organisms. They are obligatory predators. They invade and kill other gram-negative bacteria. Van Essche[33]et al was the first to evaluate the potential use of *B. bacteriovorus* for combating *A. actinomycetemcomitans* in oral infections. Sliepen[34]reported that *Bdellovibrio* was able to attack *A. actinomycetemcomitans* biofilms successfully. B. bacteriovorus has an ability in vitro to remove biofilms as well as to detach metabolically inactive biofilms.[35]

Bdellovibrio, Bacteriovorax (called 'BALOs'- Bdellovibrio and like organisms) bacterial predation as a possible approach to combat periodontal pathogens was investigated by Van Essche[36] et al. Almost all periodontal pathogens are gram-negative and potentially susceptible to BALO predation. Beneficial, periodontal microbiota are mainly gram-positive and therefore resistant to BALO predation. Their use as an antibiotic remove harmful and pathogenic bacteria and as probiotic help curb and control the bacterial populations within the intestinal tract. Hence the term "amphibiotic" was coined byMohammedDwidar[37]et alfor these kind of bacteria. Dashiff[38] demonstrated that by coculturing B. bacteriovorus 109J and M. aeruginosavorus ARL-13 with selected pathogens, predatory bacteria are able to attack bacteria from various genii.

Significance and Impact of these organisms: Infectious complications caused by micro-organisms that have become resistant to drug therapy are an increasing problem in medicine, with more infections becoming difficult to treat using traditional antimicrobial agents. The work presented here highlights the potential use of predatory bacteria as a biological-based agent for eradicating multidrug- resistant bacteria.

PORPHYROMONAS ENDODONTALIS

P. endodontalis is an asaccharolytic, black-pigmented, gram-negative anaerobic bacterium which is highly sensitive to oxygen and is therefore difficult to cultivate from clinical samples. *P. endodontalis* has been isolated from endo-perio lesions as well as from periodontitis patients. Tran[39]et al. first reported the detection of this species in periodontal pockets.Lombardo[40]*et al*. showed a high prevalence of *P. endodontalis* in addition to *P. gingivalis* and *T. forsythia*, in diseased periodontal sites when compared to healthy sites, with a statistically significant reduction after periodontal therapy. *P. endodontalis* was significantly correlated with the presence of *T. forsythia* and *P. gingivalis* in the diseased group.

TREPONEMA LECITHINOLYTICUM

Treponema lecithinolyticum is a recently described oral treponeme that exhibits strong phospholipase activity and is present at high frequency in the subgingival plaque samples of aggressive periodontitis patients. In a study by Wyss C [41], *Treponemaparvum* sp. nov., a small, glucoronic or galacturonic acid-dependent oral spirochaete from lesions of human periodontitis and acute necrotizing ulcerative gingivitis(ANUG) was identified. Small oral spirochaetes with a strict dependence on either glucuronic acid or galacturonic acid were isolated from European patients with periodontitis and from Chinese patients with either gingivitis or ANUG.[42,43]

PEPTOSTREPTOCOCCUS MICROS/ PARVIMONAS MICRA

P micros is a gram-positive anaerobic commensal of the oral cavity, comprising <3% of the subgingival flora in periodontally healthy subjects. Rams[44]*et al*. in a cross-sectional study involving 907 peoplereported prevalence of *P. micros* in 58-63% of periodontitis subjects. In culture-positive patients, *P. micros* averaged 12-15%of total viable counts and it was concluded to be potential pathogen in adult periodontitis.[44]

ARCHAEA

Archaea (Methanogens) present distinct features from bacteria and eukaryotes. The diversity of archaea is limited to a few phylotypes, constituted in particular by methane-producing archaeal organisms. Although they are possibly symbionts, methanogens may play a role in the establishment of mucosal diseases by favouring the growth of certain bacterial groups. Archaea were harbored by 36% of periodontitis patients and were restricted to subgingival sites with periodontal disease.[45] Probing depth was decreased at treated sites in association with clinical improvement. *Methanobrevibacteroralis* were frequently found in subjects with periodontal health and generalized aggressive periodontitis, especially the levels were found to be more in generalized aggressive periodontitis. Matarazzo[46] reported these organisms as an environmental modifier in generalized aggressive periodontitis.

OTHER PUTATIVE PERIODONTOPATHOGENS

Booth et al[47] designed oligonucleotide probes for Bulleidia extructa, Eubacterium nodatum, Mogibacterium timidum and Slackia exigua and extracted them from the samples with a

chemiluminescent detection method. The levels of both E. nodatum and S. exigua was significantly higher in deep than shallow pockets. The level of E. nodatum, but not S. exigua, was higher in patients than matched controls. Both E. nodatum and S. exigua were associated with clinical indicators of periodontal disease.

CRYPTOBACTERIUM CURTUM(*Kryptos*- hidden; *curtum*- shortened; a hidden rod-shaped bacterium)

Cells are short gram-positive rods, occasionally gram-variable. They are obligatory anaerobic, non-motile and non-sporing, catalase negative and asaccharolytic. Individual cells occur singly or in masses. C. curtum is characterized as an opportunistic pathogen with a typical occurrence in the oral cavity, involved in dental and oral infections such as periodontitis, inflammation and abscess. Nakazawa[48] *et al*. isolated novel *Eubacterium*-like isolates, from the periodontal pocket of an adult patient and necrotic dental pulp and named it *C. curtum*.

PREVOTELLA HISTICOLA((histus: tissue; cola; inhabitant, histicola inhabitant of tissue)

They are gram-negative nonmotile bacilli that are obligatory anaerobes. Prevotellahisticola is found in the mucosal tissues of the human oral cavity and is considered a normal flora of the human oral microbiota. It is generally commensal but is known to intrude the epithelial cells lining the cheeks. 16S rRNA gene sequence analysis and DNA–DNA hybridization revealed that the strains constituted a novel group within the genus Prevotella, being most closely related to *Prevotella melaninogenica* and *Prevotella veroralis.*[49] Colonies are 1.5-2.0mm in diameter, circular, entire, convex, cream-coloured and opaque. Some strains produce black colonies in the presence of metronidazole and other strains form bull's-eye colonies with reddish-brown pigmentation centers. Cells are saccharolytic and are able to ferment common sugars. Major amounts of acetic acid, succinic acid, lactic acid are produced as end products of metabolism in peptone/yeast extract broth.[49]

Newer species implicated in the causation of periodontitis are uncultivated clones D084 and BH017 from the *Deferribacteres*phylum, AU126 from the *Bacteroidete s*phylum, *Megasphaera*clone BB166 and clone I025 from the *TM7* phylum, and *Eubacterium saphenum.* . Species or phylotypes more prevalent inperiodontal health included two uncultivated phylotypes, clone W090 from the *Deferri-bacteres*phylum and clone BU063 from the *Bacteroidetes,* and named species *Atopobiumrimae* and *Atopobiumparvulum.*[11]

SIGNIFICANCE OF KNOWING ABOUT NEWER PATHOGENS

The subgingival pocket is a complex environment that harbours a highly diverse microbiota. It seems evident that other microorganisms might be involved in the onset and/or progression of periodontitis. In periodontitis bacteria and other pathogens could be described as the initiators of disease and the host immune inflammatory response as the promoter of tissue destruction. However owing to the chronic nature of periodontitis early initiators might have long induction periods of months or years because of which disease does not occur immediately as soon as the bacteria learns to thrive in its environment. Host immune response also throws its weight around determining if the individual becomes susceptible to disease or not.

However bacteria alone may not promote disease progression. Viruses like human cytomegalovirus and herpes virus can alter the subgingival environment increasing the pathogenicity of harmless commensals in the periodontal pocket. For instance, Slots[50]showed that the conversion of a gingivitis lesion to a periodontitis lesion and of a stable lesion to a progressing one could reflect cycles of activity and latency in herpesvirus infection of the periodontium.

It is the author's view that our current knowledge about pathogens in the dental plaque biofilm will help us to tailor-make a treatment plan for every patient. Most of our current treatment modalities still depend on the old non-specific plaque hypothesis. By investigating the susceptibility of periopathogens to mechanical therapy, probiotic therapy, surgical intervention or any other therapy we will be able to treat and control the epidemic of periodontitis without depending wholly on chemotherapeutic agents. In order to make progress of such an idea, advances have to be made in targeting individual organisms rather than the community as a whole. This will lead to majordisruption of the biofilm colony formation (cutting off their major nutrient supply)and collapse the biofilm thereby giving us huge leeway into treating periodontitis. This translates in the form of reduction of probing pocket depth or clinical attachment gain. This will also help researchers find out exactly how much host responses pave the way to progression of periodontitis.

CONCLUSION

The etiologic role of newer microorganisms would need to be confirmed by risk assessment and interventional studies to evaluate whether their reduction or elimination would be accompanied by clinical improvements and whether their persistence would lead to disease progression. In addition, further investigation into their mechanisms of pathogenicity and their ability to promote or evade host immune response would be required. Let us hope that future researches into this new world of microbial periodontics help us to treat the global epidemic of periodontitis in a better fashion.

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BASIC RESEARCH

Comparative evaluation of the effect of diode LASER and arginine containing desensitizing agent: An in vitro SEM pilot study

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ABSTRACT:

Purpose: The aim of this study was to evaluate the effect of diode LASER and arginine containing desensitizing agent on coronal dentin as measured by dentinal occlusion assessed by SEM analysis.

Materials and methods: 10 sound teeth extracted for orthodontic purpose from the patients of age group 15 to 30 years. Specimens were divided into two groups each with 5 teeth specimen. Group 1 Specimens were desensitized for 3 minutes by diode LASER and group 2 specimens were brushed with arginine containing desensitizing agent for twice in a day. The dentinal tubule occlusions of two group specimens were analyzed by scanning electron microscope.

Results : The LASER treated teeth samples shows average result of 29 % occluded dentinal tubules and the teeth samples which were treated with Arginine desensitizing agent gave a result, of an average 22% occluded dentinal tubules

Conclusion: The pilot study results shows immediate positive effect by LASER technique than the desensitizing agent used in our study. Thus we require a larger sample size to prove the same.

Key words: Dentin hypersensitivity, diode LASER, desensitizing agent, scanning electron microscope, dentinal tubule occlusion.

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INTRODUCTION:

Dentin Hypersensitivity (DH) or cervical dentin sensitivity may be defined as pain arising from the exposed dentin, typically in response to a chemical, thermal, tactile, or osmotic stimulus that cannot be explained as arising from any other form of dental defect or pathology.[1] The prevalence of this disorder has been reported in different studies to vary from 4–73%.[2]

The exposure of dentin and its sensitivity may occur via one or both of two processes: removal of enamel, or denudation of the root surface due to loss of the overlying cementum and periodontal tissues.[3]

Dentine hypersensitivity can be a potential threat to the individual's oral health because such pain may interfere with the maintenance of good oral hygiene. However it still remains a poorly understood area and consequently there appears to be no permanent treatment for this clinical condition. As per the various hypothesis of dentin hypersensitivity, hydrodynamic theory is the most commonly accepted established theory. [4,5] In accordance with this theory, dentine hypersensitivity might be reduced physiologically by formation of intratubular crystals from the dentinal fluids and saliva minerals or by the application of therapeutic chemical agent to occlude the exposed dentinal tubules.[6]

Most of these chemical compounds reduce dentinal hypersensitivity either by crystallizing inside the dentinal tubules or by forming a precipitate at the entrance of the tubule, thereby decreasing the dentinal tubular flow.[7] Various chemical compounds have been used for the occlusion of open dentin tubules such as, Silver nitrate, formalin, Glycerine , Strontium chloride, Dicalcium phosphate, Potassium nitrate, Sodium fluoride, Sodium citrate, Calcium hydroxide, Resins, Potassium oxalate, Stannous fluoride, Cyanoacrylate, and ferric oxalate .[8]

A new technology has come in treatment of dentinal hypersensitivity which shows effective relieve by physically plug and seal to the exposed dentin tubules called ProArgin. Its components are arginine, an amino acid which is positively charged at physiological pH (6.5-7.5), bicarbonate, a pH buffer, and calcium carbonate.[9]

The use of LASERs opens a new dimension in the treatment of dentin hypersensitivity. LASER mediated treatment of exposed dentine has been used to address the patency of tubular openings, causing closure of tubule openings to a depth of several microns, or to coagulate the tubular contents. Energy levels when using hard LASERs must be sufficiently low to avoid pulpal damage (shorter wavelengths), or hard tissue ablation (longer wavelengths). The most commonly explored LASERs are the low-level diode (He-Ne 633 nm, GaAlAs 810 nm) group and moderate powered diode and Nd:YAG LASER wavelengths. The effectiveness of the low-level group(Diode LASER) is thought to be through biostimulatory effect and the higher powered LASERs through heat-welding of tubule openings. [3,10]

There are limited studies in the literature showing the effective management of dentinal hypersensitivity using diode LASERs and arginine desentizing agent, therefore present study was conducted to evaluate and compare the efficacy of diode LASER and arginine desensitizing agent under scanning electron microscope to visualize the extent of the occlusion of dentinal tubules.

MATERIALS AND METHODS

Sample source

Specimens were obtained from 10 sound premolars extracted for orthodontic purpose from the patients of age group 15 to 30 years. All the teeth were stored in 10% formalin at room temperature. Severely attrited ,decayed premolar or premolars with cervical abrasion are excluded from the study.

Dentine specimen preparation

Tthe cervical 1/3rd of each premolar were prepared by using double-sided diamond disk attached to straight headpiece and the smear layer removed from specimens by treating with EDTA and Sodium hypochlorite. After preparation these dentin blocks were mounted on polyvinyl plastic plate using Cyanoacrylate adhesive(super glue).

Sampling method:

Specimens were randomly divided into two groups each with 5 teeth specimen.

Group-1: Specimens were desensitized by diode LASER for 3 minutes (1.5 w - 100mj-with 10 s interval) using DenLase Diode LASER.

Group-2: Specimens were brushed with desensitizing tooth paste (Colgate sensitive prorelief) for twice in a day.

The two groups are sectioned and analyzed for tubule occlusion under SEM.

SEM analysis

After the procedure the dentine specimens were coated with a thin layer of gold sputter and photomicrographs were taken using Scanning Electron Microscope at 3000X magnification

Statistical analysis

Percentage of occluded tubules was obtained by dividing the total number of occluded tubules by total number of tubules in each photomicrography. This result was then multiplied by 100 to obtain the percentage of occluded tubules for each photomicrography.The data was tabulated and results are statistically analyzed by chi square test.

RESULTS

The group 1 specimens (LASER treated teeth samples) presented an average result of 28.6 % (Table 1) occluded dentinal tubules and group 2 specimens which treated with Arginine tooth paste presented with an average of 22% occluded dentinal tubules (Table 2).

When the percentage of tubule occlusion in group 1and 2 are compared, there was a significant difference between both the groups. Group 1 specimen showed the most occluded dentinal tubules.

On the basis of chi-square test there is a significant difference of scores between group 1 and 2 (p value <0.05). Comparison of dentinal tubule occlusion ability within diode LASER and arginine desensitizing agent data was statistically significant.

DISCUSSION

This study was performed to compare the effects of diode LASER and arginine desensitizing agent by comparing dentinal tubule occlusion by scanning electron microscope. Our study shows significant dentinal tubule occlusion by the LASER treated samples compared to arginine desensitizing agent treated samples. In photomicrographs the more fully occluded tubules and cracks are observed in LASER treated samples compared with the arginine desensitizing agent treated specimens.

Gautham Kumar (2005) conducted a short term assessment of the Nd:YAG LASER with and without sodium fluoride varnish in the treatment of dentin hypersensitivity on 40 patients. The study results showed that the combination of Nd:YAG LASER and 5% sodium fluoride varnish seems to have an impressive efficacy, when compared to either treatment alone, in treating dentin hypersensitivity. The SEM findings seem to relate to the clinical findings since that reduction in number/patency of tubules were associated with improvement in treatment efficacy.[3]

Study by Romeo Umberto et al (2012) using GaAlAs diode LASER alone and with topical sodium fluoride gel (NaF) reported that diode LASER is useful device for dentin hypersensitivity when used alone and used with NaF gel.[11] High resolution scanning electron microscopy (SEM) images have verified that the arginine-calcium carbonate desensitizing paste provides complete occlusion of open dentin tubules, and freeze-fracture images have demonstrated that the plug reaches a depth of two microns into the tubule. [12]

The study by D Cummins reported that significant reductions in dentin hypersensitivity immediately after single application of arginine desensitizing agent.[13] The clinical efficacy of arginine desensitizing agent is reported by various other studies by F Ayad et al, T Schiff et al, Samuel SR et al.[14-16]

The results of our study using SEM analysis, in LASER treated samples ,sample 1 shows average of 25.8 % occluded tubules, sample 2 - 29.62%, sample 3- 31.25%, sample 4- 27.77 %, sample 5 – 28.57% with a total average of 28.60 % closed tubules and 71.4 % open tubules .Whereas the specimens treated with arginine desensitizing agent shown an average occluded tubules in sample 1 are 23.33%, sample 2- 20, sample 3-21.42%, sample 4- 25%, sample 5 -21.81% with a total average of 22.31% occluded tubules and rest are opened tubules (77.69%). The result of our study shows need of multiple application of diode LASER and arginine desensitizing agent to reduce the percentage of opened tubules.

Table 1 : Total occluded tubules in teeth treated with LASER

Group 1	Sample number	Occluded tubules %	Avg. Occluded tubules %
Teeth Samples treated with LASER	Sample 1	25.8	28.6%
	Sample 2	29.62	
	Sample 3	31.25	
	Sample 4	27.77	
	Sample 5	28.57	

Table 2 : Total occluded tubules in teeth treated with tooth paste

Group 2	Sample number	Occluded tubules %	Average Occluded tubules %
Teeth Samples treated with tooth paste	Sample 1	23.33	22.31%
	Sample 2	20	
	Sample 3	21.42	
	Sample 4	25	
	Sample 5	21.81	

CONCLUSION

LASER treated teeth samples shows more percentage of occluded dentinal tubules than the teeth samples treated with arginine desensitizing agent. The results of our study gave positive approach towards the immediate treatment procedure for dentin hypersensitivity by using diode LASER procedure shows significant decrease of dentin hypersensitivity when compared to arginine desensitizing agent. The opened tubules

in the both samples shows the need of further study about multiple application and long duration of application of LASER and desensitizing agent by using large sample size.

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Analysis of mineral contents of dental calculus & assessment of its similarity with saliva

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ABSTRACT

Aim: To assess the similarity in mineral composition of dental calculus and saliva.

Materials&Methods:The dental calculus collected from patients mouth wasassessed under UV spectrometer &Inductively Coupled Plasma Mass Spectrometer (ICP-MS) for its mineral contents.

Result: Within the limitations of the spectrometer used, the given sample of calculus contained Calcium (11.43%), Magnesium (5080.64 mg/kg), Sodium (5096.60 mg/kg), Phosphorus (413 .64 mg/kg)&Zinc (140.22mg/kg).

Conclusion: Analysing the complete mineral content of calculus needs much better assessment techniques. The spectrometers used could detect mainly inorganic components like Calcium, Magnesium& Phosphorus and trace amount of Sodium and Zinc. The mineral components were almost same as that of saliva

Keywords : Dental calculus, saliva, minerals, calcium, spectrometer, inductively coupled plasma

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INTRODUCTION:

Research Question: Is there any similarity in the mineral composition of dental calculus and saliva

Bacterial plaque is believed to be the prime initiating factor of periodontal disease along with other predisposing factors including local, genetic, environmental and acquired factors.[1] The dental calculus is formed by the mineralization of the bacterial plaque, resulting from its interaction with the influx of mineral salts from saliva or GCF.[2]Saliva is known to be a reservoir of minerals that continuously remineralise the enamel and also become a source of calcification of plaque. The mineral content within calculus is explained by periodic differences in surrounding environment which is primarily saliva.[3] A study that could assess the mineral content of dental calculus could reveal its relationship with the saliva. Such a study was conducted her with a rationale of

assessing the similarityin the mineral composition of dental calculus and saliva.

AIM :

To know the similarity in the mineral composition of dental calculus and saliva.

OBJECTIVES:

- To identify and quantitate the mineral content of dental calculus
- Compare the mineral contents of dental calculus and saliva.

MATERIALS:

1. Materials to collect, transport and store calculus
2. Chemicals needed for the analysis: Distilled water,0.02N HCL/H2SO4, methyl orange, water, supra pure nitric acid/sub boiled nitric acid, NIST traceable calibration standards, polypropylene bottles, polypropylene volumetric flasks, polypropylene pipettes, phenolphthalein indicator aqueous solution, ammonium molybdate, concentrated H2SO4,stannous chloride, glycerol, anhydrate potassium phosphate,
3. Visible UV spectrometer.
4. Inductively Coupled Plasma Mass Spectrometer (ICP-MS): Thisis used as type of mass spectrometry which is capable of detecting metals and several non-metals at concentrations as low as one part in 10^{15} (part per quadrillion, ppq) on non-interfered low-background isotopes. This is achieved by ionizing the sample with inductively coupled plasma and then using a mass spectrometer to separate and quantify those ions.

METHODOLOGY:

The dental calculus for inorganic content assessment was collected from the lower anterior lingual side of teeth region. The calculus sample collected with sickle scaler (U15/30) and stored in sterileplastic bottle for chemical analysis.Mainly three chemical analysis where done

1. Test for determination of Carbonates[4]
2. Heavy metal analysis [5]
3. Test for determination of Phosphates[6]

Test for determination of Carbonates:

Principle: The alkalinity of water is its acid neutralizing capacity. The Hydroxyl ions are present in a sample as a result of dissociation or hydrolysis of solutes that react with the added standard.

Reagents: 0.02N HCI/ H_2SO_4,Methyl Orange.

Procedure:100 ml of the sample is titrated against 0.02N HCI/H_2SO_4 using methyl orange as indicator. End point is the change of colour from golden yellow to orange red.

Calculation: Total alkalinity (as Caco3/L) = Titre valuex1000x N x 50/sample volume

Heavy metal analysis:

Principle: Sample is introduced into the instrument using a peristaltic pump, into a nebulizer. The nebulizer nebulizes the sample into small droplets and passes it into argon based high temperature plasma. Energy transfer from the plasma to the sample stream causes desolvation, atomization, and ionization of target analytes. Ions generated by this energy – transfer processes are extracted from the plasma through a differential vacuum interface, and separated on the basis of their mass-to-charge ratio by mass spectrometer. The ions passing through the mass spectrometer are counted by an electron multiplier detector.

Reagents

- Supra pure Nitric acid, or Sub boiled nitric acid
- NIST traceable Calibration standards

Apparatus

- Polypropylene bottles for storing standards
- Polypropylene volumetric flasks for preparing standards
- Polypropylene pipettes
- Inductively coupled plasma mass spectrometer

PROCEDURE:

Stock Solution: Prepare 1 ppmstock solution by pipetting 1 ml of 9 element standard in to a 100 ml standard flask and make up to the mark using water (SIEMENS water purifier).0.25g to 0.5 g sample is weighed accurately in to MDS digestion tube.Add 5.0 ml conc. HNO_3(extra pure), 0.5 ml conc.HCl(extra pure) and 1.0 ml H_2O_2 (extra pure), and allow 15 min. self-digestion. Tighten the cap and keep for digestion in the MDS. After digestion it was quantitatively transferred in to 50 ml tube and make up to 50 ml using extra pure water.

Calculation

Element (ug/L) = Concentration from calibration graph (ug/L) x dilution factor

Test for determination of phosphates

Principle: Molybdophosphoric is formed and reduced by stannous chloride to intensely colored Molybdenum blue. The intensity of blue colour complex was measured at 690 nm and quantified from standard calibration curve.

Reagents

- Phenolphthalein indicator aqueous solution
- Ammonium Molybdate reagent: Dissolve 25gm Ammonium Molybdate in 175ml dist.water. Cautiously add 280ml con. H_2SO_4 to 400 ml dist. water. Cool, add molybdate solution, and dilute to 1 Litre.
- Stannous Chloride reagent: Dissolve 2.5 gm fresh stannous chloride in 100 ml glycerol heat in a water bath and stir with a glass rod to hasten dissolution.
- Standard phosphate solution: Dissolve in distilled water 219.5mg anhydrous KH2PO4 and diluted to 1000ml.1ml - 50µg PO_4^{3-}-P.

Apparatus:Spectrophotometer for use at 690 nm.

Procedure:

- Sample pH adjustment:If sample pH >10, add 1 drop of phenolphthalein indicator to 50 ml sample and discharge the red colour with (1:1) HCl before diluting to 100 ml
- Colour development in the sample: To 100 ml sample add 4ml molybdate reagent and 0.5ml stannous chloride reagent. After 10 minute but before 12 minute measure the color photometrically at 690 nm.
- Standard phosphate solution: Dissolve 219.5mg anhydrous potassium di hydrogen orthophosphate and dilute to 1000ml. 1ml = 50 µgm PO_4^{3-} P
- Prepare a blank in which 35 ml distilled water is substituted for the sample. After 10 min or more measure absorbance of sample versus a blank at a wavelength of 410 nm.

Calculation:Mg P/L = Concentration in mg/l (directly from calibration graph)

RESULTS:

SI No	Parameters	Results
	Heavy metals	11.43%
1.	Calcium	5080.64mg/kg
2.	Magnesium	5096.60mg/kg
3.	Sodium	140.22mg/kg
4.	Zinc	
	UV spectrometer Analysis	
5.	Phosphates	413.64mg/kg
6.	Carbonates	Nil

The major inorganic components of Saliva include Sodium (2–21 mmol/L), Potassium (10–36 mmol/L), Calcium (1.2–2.8 mmol/L),Magnesium (0.08–0.5 mmol/L), Chloride (5–40 mmol/L), Bicarbonate (25 mmol/L), Phosphate (1.4–39 mmol/L). [7]

DISCUSSION:

A chemical analysis of the dental calculus was done with an objective to know the mineral content & compare it with that of saliva.By the analysis with UV visible spectrometer& spectrometer (ICP-MS), the dental calculus was observed to contain mainly Calcium, Magnesium,Phosphate& in trace amounts of Sodium and Zinc. Carbonates which included in the main component of dental calculus which is not detected in this sample.Other elements which are in trace amounts are also not detected.The minerals found in calculus in the present study was similar to the content of saliva.[8]

CONCLUSION:

The composition of calculus is highly influenced by the nature of saliva. [5,9,10]The mineral content of calculus of different individuals are explained by the differences in the nature of saliva.[8] The present study assessed the mineral composition of calculus and found it to be similar to the chemical composition of saliva. This study confirms the earlier hypothesis of calculus formation which supports the mineralization of plaque by saliva owing to its similarity in chemical composition.

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