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President's message

Dear colleagues,

Wish you all a very fruitful and prosperous new year.

Hope by this year we will be able to overcome this dreaded corona threat and regain our normal way of life.

Finally the clinical establishment bill is going to be a reality even though the bill was passed in 2018 its implementation was extended, now the govt: is trying to get it implemented but every target group is resisting due to various reasons. Our main concern is about non representation in the District Registering Authority. IDA had many talks with the govt: to get proper representation in the DRA and if we stand together by not registering now, surely we will get representation. The aim of the govt: is to control and regulate every clinical establishment including hospital, clinics, labs, physiotherapy centers etc in all fields of medicine. So anyone who is providing any type of treatment will be forced to register under this act. Failure to do so will attract huge fines starting with fifty thousand to lacks.

Once you register every complaint against you will be settled by a DRA. Unfortunately at present the dental profession doesn't have a representative in that forum, so the complaints will be handled by other doctors who may not be familiar with our problems and limitations. If they decide that we are at fault, hefty fines reaching lacks may be imposed or they can even close the establishment permanently. Even though a provision to approach the appellate authority is present, you cannot approach civil courts to challenge their decisions. As per the act those govt: officials are immune to any actions/punishments from anybody even though they were proved wrong later.

Initially we have to register provisionally and within two years time we have to get permanent registrations which is valid for three years. For which we have to fulfill the proposed criteria's and face multiple inspections. So once every three years we have to repeat this cumbersome process.

Once the bill is in force we have to exhibit our charges on a prominent place inside the clinic, so in the near future you can expect new apps developing (as in the case of hotel rooms and airline fares) to help people to compare the charges to choose the cheapest. This will lead to a price war which in turn will bring down the quality of dental treatment in Kerala. Even though at present we are allowed to charge as we consider proper, in the future the govt: might put a sealing for that also.

While the bill is considered as a boon for the public the medical fraternity is not at all getting any benefit. It would have been a positive step if the govt: made this as a single window registration and spared us the trouble of all other local body, PCB, AERB registration etc.

Thank you

Dr Sabu Kurian
President, SPIK

Secretary's Message

Dear SPIK members,

Another calendar year is rapidly coming to an end and the pandemic seems to have an extended stay amidst us. Yet, along with the challenges, new opportunities and new avenues have opened up for people in all spheres of life.

As we are aware, dentistry in general has taken a downward spiral in the last few years as a career option among aspirants of professional courses. The same is applicable our specialty when it comes to the choice of post-graduate courses, as observed from the number of vacant seats in Periodontics remaining after multiple rounds of MDS allotments. The impact of this issue extends beyond unfilled PG seats; rather, it points to a developing apathy among dental graduates towards the significance of Periodontics in dental practice. SPIK, in its part, has been trying to highlight the role of the specialty through one of our flagship programmes, the SPIK Periodontology Scholarship Examination for undergraduate students. Due to the COVID scenario, we were unable to conduct the exam this year. However, we hope to conduct the same during February, 2022.

As informed earlier, our President, Dr Sabu Kurian, is in the active process of creating a patient awareness video for Periodontics, which I am sure will go a long way in accomplishing the mission and vision of our society.

I express my sincere gratitude to our editor, Dr.Sameera G Nath for meticulously carrying out the editorial responsibilities in spite of her busy academic schedule. Our best appreciation to Dr.Sameera shall be in the form of our scientific contributions to the journal.

Wishing you all a very happy, healthy, peaceful, and prosperous 2022.

Dr. Jayan Jacob Mathew
Secretary, SPIK

INFORMATION TO AUTHORS

About the Journal

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JSPIK

Comparative evaluation of root surface characteristics following instrumentation with hand instrument, ultrasonic scaler and rotary carbide bur: An in vitro scanning electron microscope study

Jose Paul[1], Johnson Prakash D'lima[2], Senny Thomas Parackal[3], Veena Venugopal[4]

ABSTRACT

Background: Periodontitis is an inflammatory disease caused by opportunistic bacteria residing in the oral cavity, leading to the loss of supporting tissues of the teeth. Bacterial plaque and calculus are recognized as etiologic agents in the initiation and progression of periodontal disease, and their accumulation and attachment are facilitated by a roughened root surface. To create a biologically acceptable root surface, subgingival plaque and calculus must be eliminated, followed by a careful debridement of superficial endotoxin containing layers of root cementum. Therefore, a thorough debridement of the root surface is of prime importance in the treatment of periodontal disease.

Materials and methods: A total of 30 teeth were divided into three groups .Two test groups which were instrumented using ultrasonic scaler and rotary carbide bur and a control group in which instrumentation was done using Gracey curettes. In each case time required for scaling and root planing and surface roughness using Roughness and Loss of Tooth substance was measured.

Results: The results revealed a statistically significant decrease in Roughness and Loss of Tooth substance with ultrasonic scaler followed by hand instrument and rotary bur. Rotary bur produced maximum roughness among the three groups and was more time consuming.

Conclusion: Within the limitations of this study it can beconcluded that results favored use of ultrasonic scaler in root surface instrumentation compared to hand instrument and rotary bur.

Keywords: gracey curette, periodontitis, root planing,ultrasonic scaler, rotary carbide bur

Introduction

Periodontitis is an inflammatory disease caused by opportunistic bacteria residing in the oral cavity, leading to the loss of supporting tissues of the teeth. Bacterial plaque and calculus are known to be causative agents in the onset and progression of periodontal disease, and a roughened root surface facilitates their accumulation and attachment.

To create a biologically acceptable root surface, subgingival plaque and calculus must be eliminated, followed by a careful debridement of superficial endotoxin containing layers of root cementum. Therefore, a thorough debridement of the root surface is of prime importance in the treatment of periodontal disease. The first steps in the treatment of adult periodontitis are scaling and root planing. They aim at removing gingival inflammation, eliminating or shifting the bacterial microorganisms from gram - negative anaerobes to gram positive facultative bacteria to establish health. [1]

Scaling is the process of removing all supragingivaluncalcified and calcified accretions, as well as any gross subgingival accretions, using instruments. Root planing is the process of removing microbial flora from the root surface and in the pocket, as well

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as all calculus flakes and contaminated cementum and dentin. [2] Earlier hand instruments were the first choice for SRP. Though hand instruments produced a smooth surface, it requires optimal manual dexterity for their effective instrumentation. Periodontal root planing procedures aimed at removing dental plaque and calculus from the root surface also, by default, remove a portion of the root surface. [3]

Also root surface instrumentation with hand instruments is time consuming and inaccessible in deep pockets. [4] Various powered instruments available to the clinicians for mechanical root preparations include sonic, ultrasonic, and rotary instruments.

Ultrasonic instruments were designed to remove supragingival calculus and stains in the first place. These power-driven instruments have recently been updated to include smaller diameter tips and longer working lengths, allowing for easier access to deep probing sites and more efficient subgingival instrumentation. Although ultrasonic tools are simple to use, achieving a smooth and calculus-free root surface can be difficult. Rotary instruments for scaling and root planing have been designed to alleviate the limitations associated with the use of ultrasonic and manual scalers.

Materials and Methods

The study wasconducted on 30 extracted single rooted teeth of patients diagnosed with chronic periodontitis and poor prognosis reporting at the Department of Oral and Maxillofacial surgery, Annoor Dental College, Muvattupuzha.

The 30 sample is divided into

GROUP I - Instrumentation done using curette

GROUP II- Instrumentation done using ultrasonic scaler

GROUP III-Instrumentation done using rotary bur

Criteria for inclusion included individuals in the age group of 40-60 years diagnosed with periodontitis, mandibular incisors with calculus index score of 2 or 3 andteeth extracted due to grade II or grade III mobility. Teeth that had undergone root canal treatment, associated with periapical lesion or caries and with developmental defects, abnormal morphology and fracture were excluded from the study.

Armamentarium

1. Gracey curette, No. 1/2, 3/4. (Hu-FriedyCo, Chicago, IL, US).

2. Ultrasonic instrument (EMS SA, Munchen, Germany) and Subgingival PS Ultrasonic tip.

3. Rotary carbide bur (Tapered fissure)

Teeth was collected following extraction and then washed with distilled water and treated with 2% sodium hypochlorite solution and stored in normal saline. Teeth are mounted on a Plaster of Paris cube of 2cm height with the crown portion being immersed in the Plaster of Paris and the root portion projecting upwards and the teeth randomly divided as per the designated groups.

Mesial root surface is chosen for instrumentation. 2mm below the CEJ. An area of 1cmx 0. 5cm is

Fig 1: Curettes, ultrasonic scaler and bur with hand piece

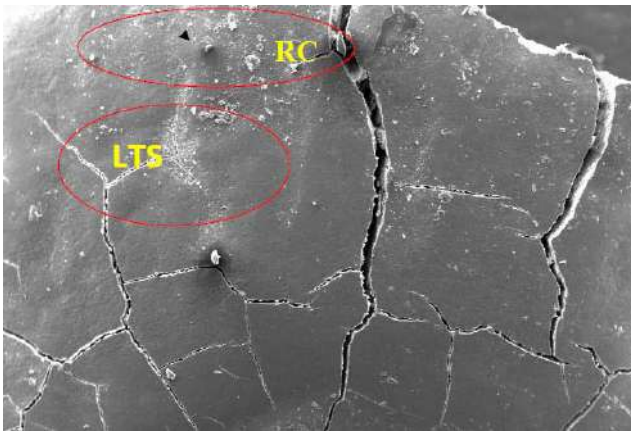


Fig 2: Morphology of root surface planed with hand curette SEM photograph 50x magnification

demarcated in the mesial surface with the help of a bur. The root surface is then scaled using the different instruments according to the assigned groups based on random sampling procedure.

With Gracey Curettes no. 1-2 and 3-4 [Hu-Friedy, USA] used for the instrumentation, long moderate to light pull strokes will be given on the proximal surface along the long axis of the tooth.

Piezo-electric ultrasonic scaling unit was used for instrumentation. A sub-gingival ultrasonic tip used according to the manufacturer's instruction under profuse rinsing with water spray at medium power setting.

Rotary burs were used with lightpressure and water spraying. Unidirectional strokes given on the proximal surface along the long axis of the tooth. After instrumentation, 7-8 mm of the treated root surface will be cut using a carbide disc from the cementoenamel junction and apical root surface and crown portion will be discarded.

Specimens were evaluated and scored based onRoughness loss of tooth substance index:[5]

0: Smooth or even root surface, without marks from the instrumentation and with no loss of tooth substance.

1: Slightly roughened or corrugated local areas confined to the cementum.

2: Definitely corrugated local areas where the cementum may be completely removed, although most of the cementum is still present.

3: Considerable loss of tooth substance, with instrumentation marks extending into the dentin. The cementum is completely removed in large areas or there are a considerable number of lesions due to instrumentation.

Analysis was done in Scanning electron microscope JEOL Model JSM-6390 LV.

Time required for scaling and root planing of 1 x 0. 5 cm area with each instrument was measured using stopwatch from the start, until the root surface appeared smooth and again upon visual inspection and examination using an explorer.

Statistical Data Analysis

The study was conducted to compare root surface roughness following instrumentation with hand instrument, ultrasonic scaler and rotary carbide bur and time required for instrumentation using these instruments. One way ANOVA is used to test the null hypothesis. Post Hoc Analysis is used to test the mean differenceof roughness and loss of tooth substance between the groups.

In all the analysis significance level is taken to be 0. 05 (i.e., if the p-value isless than 0. 05, reject the null hypothesis or it can be concluded that the null hypothesis is statistically significant). Statistical Analysis was carried out using statistical package for social sciences (SPSS) version 24

Ethical considerations

The study was presented before the Institutional review board and was approved by the Institutional human ethical committee (IHEC REF NO: 018-A/O8)

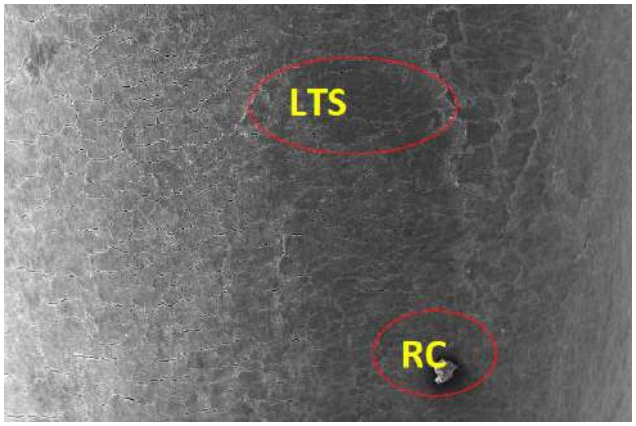


Fig 3: Morphology of root surface planed with ultrasonic scaler SEM photograph 50x magnification

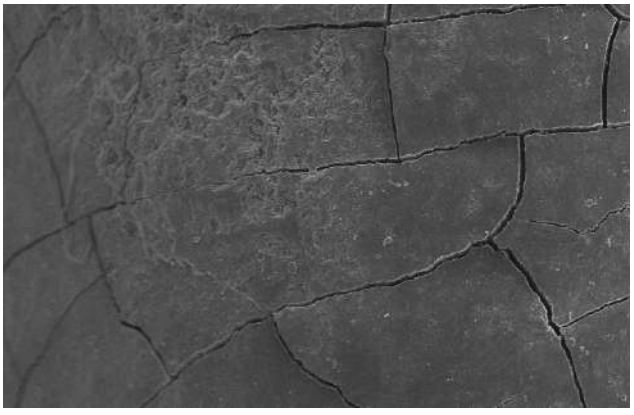


Fig 4: Morphology of root surface planed with rotary bur SEM photograph 50x magnification

RESULTS

The results are summarised in tables given below.

Discussion

"The most significant measure in the treatment of calcic inflammation of the periodontal membrane and gums is the removal of the concretions from the teeth, followed by an active determination in the mind of the patient to keep them clean in the future," G. V. Black wrote in 1886. Even in the present, the above said statement is true. Scaling and root planing are the routine measures employed for the treatment of periodontal disease. There are various instruments to remove these deposits of plaque and calculus from the tooth surfaces. However these instruments can also lead to the damage of the root surface.[6]

This study is an in vitro study carried out to evaluate the efficacy of three different instruments in scaling and root planingby measuring the RLTSI under SEM and also by measuring the time required for instrumentation. To permit standardization of the experimental condition and also to facilitate the selection of comparable test surface this study was done as in vitro as it is difficult to attain this in in-vivo due to variations in accessibility. Also the use of SEM can eliminate the bias caused by other methods. It has high resolution with great depth of focus and also can view the bulk specimen rather than a thin section. Thus with a bulk specimen more definite structure of root surface can be obtained. The use of scanning electron microscopy has also given valuable information regarding root surface morphology following periodontal instrumentation.[7]

SRP procedures were carried out by one operator alone to eliminate inter-operator variability and also to minimize the force and pressure applied during instrumentation. In this study, microscopic examination of specimens treated with hand curettes showed

Table 1: Comparison of Roughness and loss of tooth substance index score

Groups	*No. of specimen*	*Total no. of score*	*Mean*	*Std. Deviation*	*F value*	*p value*	*Remark*
Hand Instrument	10	21.5	2.150	0.242	73.707	<0.001	HS
Ultrasonic Scaler	10	14.0	1.400	0.211			
Carbide Bur	10	26.5	2.650	0.242			

One way ANOVA, *Significant at 0.05 level, HS- Highly Significant

Here one way ANOVA used to compare Roughness and loss of tooth substance index score between the groups. The mean values of Group 1, Group 2 and Group 3 are 2.150, 1.400 and 2.650 respectively. The calculated F value is 73.707 with p value < 0.001. So that we can conclude that there is a significant difference in Roughness and loss of tooth substance index score between the groups.

Table 2: Inter group comparison between hand instrument, ultrasonic scaler, and carbide bur

Multiple Comparisons

Group		*Mean Difference*	*p value*	*Remark*
Hand Instrument	**Ultrasonic Scaler**	0.750*	<0.001	HS
Hand Instrument	**Carbide Bur**	-0.500*	<0.001	HS
Ultrasonic Scaler	**Carbide Bur**	-1.250*	<0.001	HS

*. The mean difference is significant at the 0.05 level., HS- Highly Significant

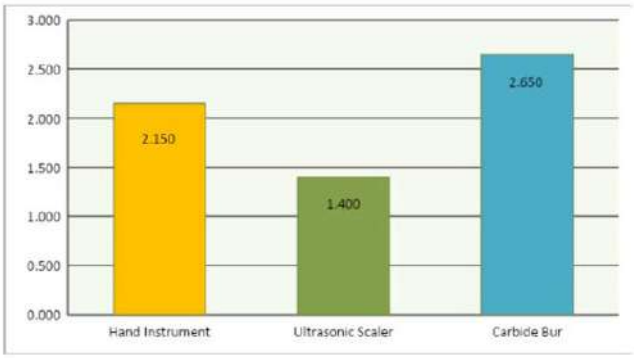
Table 3: Comparison of Time taken for instrumentation

Groups	*No. of specimen*	*Total no. of score*	*Mean*	*Std. Deviation*	*F value*	*p value*	*Remark*
Hand Instrument	10	222.0	22.200	1.619	222.113	<0.001	HS
Ultrasonic Scaler	10	131.0	13.100	2.424			
Carbide Bur	10	329.0	32.900	2.183			

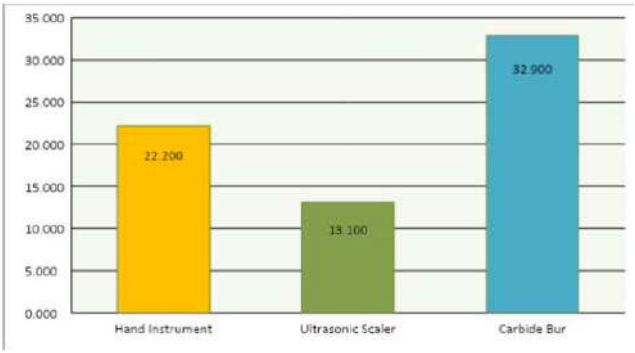
One way ANOVA, *Significant at 0.05 level

Here one way ANOVA used to compare Measurement of time for instrumentation between the groups. The mean values of Group 1, Group 2 and Group 3 are 22.200, 13.100 and 32.900 respectively. The calculated F value is 222.113 with p value < 0.001. So that we can conclude that there is a significant difference in Measurement of time for instrumentation between the groups.

Graph 1: Bar chart for roughness and loss of tooth substance



Graph 2: Bar chart for time for instrumentation



more amount of remaining calculus compared to other modes of instrumentation (US and R) and was also statistically significant. In studies by Ewen and Gwinnet[8] ultrasonic instruments have been shown to be superior to hand curettes. These studies concluded that ultrasonic instruments provided a surface biocompatibility, and they are more effective in removing endotoxin from periodontally affected root surfaceswhich is in agreement with our study. There are only few reports on the use of rotary bur for removing calculus. The reports are conflicting with our study. In our study, ultrasonic instruments effectively removed calculus compared to hand curettes and rotary bur, whereas in the other studies by Lie and Meyer[9] and Marda et al[10] hand curettes, ultrasonic and rotary were equally effective in removing calculus. This discrepancy may be due to various factors like differences in experimental design, sharpness of the instrument, strokes, working time or in the assessment of the effects.

In all the three groups group, group II and group III there were deep instrumentation marks and striae present. This represents the pathway of instrumentation and also causes considerable amount of loss of tooth substance. In the present study scoring of RLTSI was highest for rotary followed by hand curette and was the least for ultrasonic scaler. The mean score was 2. 150±for Gracey curette and 1. 4 ± 0. 211 for ultrasonic scaler and for rotary bur 26. 5±0. 242. Studies by Ewen et al[8] demonstrated no significant differences in loss of tooth substances whereas, study by Pameijer et al[11] concluded that ultrasonic removed less amount of tooth substance when compared to other modes of instrumentation. This high mean value suggests that the teeth treated with rotary bur had more amount of roughness and loss of tooth substance. The cuts produced by the rotary bur can penetrate into dentin which can be regarded as potentially harmful to the teeth, since dental debridement and calculus removal are routine procedures that are to be repeated many times during the life span of a tooth. This can also lead to opening of great numbers of dentinal tubules resulting in bacterial penetration and hypersensitive pain reactions.

Studies by Bye et al and Meyer et al[11] demonstrated that hand instruments produce significantly smoother root surface than ultrasonic scalers, whereas Jacobson et al.[12] reported that Ultrasonic scaler produced a smoother root surface than hand instruments which is in accordance with our study. When rotary instruments at high speed (2,00,000 revolutions per minute) and ultrasonic instruments were compared to hand curettes, Allen EF and Rhoads 32 found that rotary instruments at high speed (2,00,000 revolutions per minute) and ultrasonic instruments caused higher root surface damage. Scanning electron microscopy results showed that the piezosurgery ultrasonic scaler leaves a smoother surface compared with Gracey curettes, termination diamond burs and piezoceramic ultrasonic scaler. Surfaces treated with termination diamond burs appeared to result in more scratches and pits than the other methods of instrumentation. In earlier studies root surface roughness was measured using size of instrument marks and loss of tooth substance by evaluating under a light microscope. Results of such studies are inconclusive and variable. Scanning electron microscope eliminates such difficulties in assessment of root surfaces and produces definite results. Shortcoming of the study may be limited number of samples used in the study. Larger sample size with the various other instruments used for scaling and root planing under scanning electron microscope may provide better scientific evidence.

Conclusion

Within the limitations of the present study it can be concluded that hand instrumentation and ultrasonic scaling causes less root surface roughness significantly when compared to the scaling and root planning carried out with rotary bur. According to these results we can conclude that ulltrasonicscaler is superior than hand curettes and rotary bur. Ultrasonic scaler is less time consuming mode of instrumentation and produces smoother root surface. Mean time for instrumentation is 22.2s, 13.1s and 32.9s for Gracey curette, ultrasonicinstrument and rotary instrument respectively. Mean Roughness and Loss of Tooth substance is 2.15, 1.4 and 2.65 for Graceycurette, ultrasonic instrument and rotary instrument respectively.

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JSPIK

Surgical exposure of canine: Periodontal perspective and surgical algorithm

Riyas S[1], Santhosh Kumar S[2]

ABSTRACT

Maxillary canine has a crucial role in maintaining occlusion and smile. Impacted canine is a common clinical problem during orthodontic treatment. Orthodontic correction of impacted canine is clinically challenging. Aim of this article is to review the literature from a periodontal perspective regarding surgical exposure of canine and explaining a surgical algorithm for appropriate selection of surgical technique. Exposure of impacted canine is done most commonly by apically positioning the flap, uncovering by excision, and closed eruption technique. In case of surgical exposure of the canine the amount of keratinized gingiva is considered as the main criteria. Following the surgical algorithm, for surgical exposure of canine help in reducing orthodontic challenges related to the positioning of impacted canine on to the dental arch.

Keywords: canine exposure, surgical uncovering, periodontal surgical exposure, esthetic periodontal surgery

Introduction

The permanent canine place a major role in achieving ideal functional occlusion and designing a balanced smile.[1,2] An unbecoming surgical exposure of impacted canine will result in unpredictable aesthetic outcomes and orthodontist faces a difficult time in redirecting impacted canine into the dental arch . In case of choosing proper surgical technique for orthodontic correction of impacted canine. If the proper exposure method is chosen to expose an impacted canine, it will result in favorable and stable aesthetic outcome. This review discusses various surgical technique and algorithm for exposure of impacted canine prior to orthodontic treatment.

Development of canine

It is around the 4-5 months that calcification of canine tooth starts and it is located in the maxillary sinus beneath the floor of the orbit. The tooth is located above the root of lateral incisor till the crown get calcified.[3] Enamel formation is completed in 6-7 years. At the age of 11-12 eruption completed by active and passive process. Root completion of canine take place in 13-15 years.

There are two theories explaining why maxillary canine is displaced from the dental arch. Genetic and guidance theories. In guidance theory canine use root of lateral as a guide for eruption and genetic theory relate to dental anomalies.

Incidence of Canine Impaction

Maxillary canine impaction occurs approximately 1 - 2% in the general population. Eight percent of total maxillary canine impacted teeth have a bilateral presentation and incidence of maxillary canine impaction is twice that of mandible.[2] Maxillary canine impaction mostly present in palatal side 85% while 15% are labial impaction.

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Etiology of Impacted Canine

There are various etiologic causes including local, systemic, genetic causes. Local causes such as root dilaceration, absence of lateral incisor, dilaceration of root, variation in the timing of development of root of lateral incisor. Systemic causes like endocrine deficiency, febrile disease and irradiation. Genetic causes include heredity, malposed tooth germ, presence of an alveolar cleft. Arch size tooth length discrepancy may determine the impaction is palatal or buccal side.[2] insufficient space and crowding result in impaction of canine in buccal aspect, while spacing in the upper arch result in palatal canine impaction.

Localization of maxillary canine

The periodontist should evaluate the impacted canine clinically and radiographically

Clinical evaluation: Check the patient for having any of the following clinical features which gives an idea about the canine tooth is impacted or not

1. Absence of canine bulge in maxillary anterior region after 11-12 years of age
2. Canine bulge present in the palatal area
3. Permanent canine not erupted after 14 to 15 year of age
4. Prolonged retention of the deciduous canine after 14 to 15 year of age
5. Presence of dental anomalies in the lateral incisor.[2]

Mobility of neighboring teeth give an idea regarding the root resorption. Palpating the canine bulge helps to locate buccal or palatal positioning of canine in the dental arch. Study model analysis helps to identify arch length tooth size discrepancy in the dental arch.

Radiographic Assessment: Radiographic evaluation should be done in an individual with unerupted and non-palpable canine after the age of 11 years and before surgical exposure of canine for orthodontic extrusion. Localization of impacted canine in the dental arch is indispensable role prior to surgery.[8]

Canine localization can be done with:

1. Intra oral radiograph
   - IOPA
   - Occlusal
2. Extra oral radiograph
   - OPG
   - Lateral cephalometry
3. Digital imaging
   - CT
   - CBCT

- Intra Oral Radiograph

Clarke's rule tube shift technique IOPAR help in locating canine positioned buccally or palatally in the arch and occlusal radiograph helps to localization of canine whether it is buccal or palatal.

- Extraoral Radiograph

Orthopantomogram help in localizing impacted tooth in all three planes and relationship of impacted canine with other structure can be studied with Lateral cephalogram. Superimposition of images in anterior region is a limiting factor of orthopantomogram.

- Digital Imaging

Help in reduction of superimposition and provide a clear visualization of entire maxillary region. This three-dimensional volume of information helps in localizing the tooth in the entire maxillary region

Compared with conventional 2D images, CBCT imaging gives an idea of impacted canine in three planes:- sagittal, axial and coronal plane providing valuable information to localize impacted canines.[9]

Surgical techniques employed for exposing impacted maxillary canine

- Labially positioned impacted canine
  - o Open surgical techniques
  1. Uncovering by excision
  2. Apically positioned flap
  - o Closed eruption techniques
  - o Closed eruption and tunnel traction technique
- Palatally impacted canine
  - o Open surgical techniques
  1. Uncovering by excision
  2. Apically positioned flap
  - o Closed eruption techniques
  - o Modified window technique

Open Surgical Techniques[10,11]

Superficial impaction can be exposed by excisional uncovering or apically positioned flap. Crown of impacted canine is always exposed after open surgical procedure.

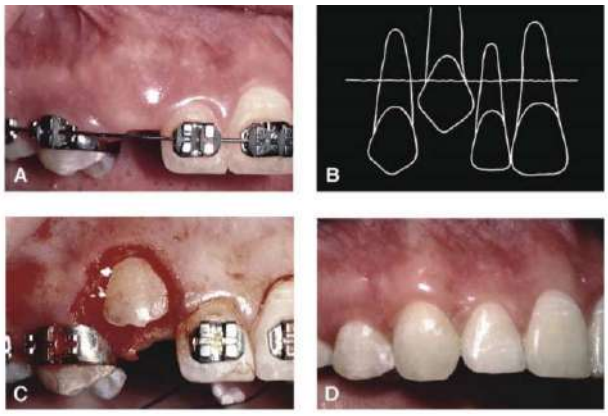


Fig 1: Excision uncovering - A, Impacted maxillary right canine B, Tooth was labially positioned, coronal to the mucogingival junction, and adequate width of attached gingiva C, excisional uncovering done by gingivectomy. D, after orthodontic correction.

[Courtesy: Kokich VG, Mathews DP. Surgical and orthodontic management of impacted teeth. Dent Clin North Am. 1993 Apr;37(2):181–204]

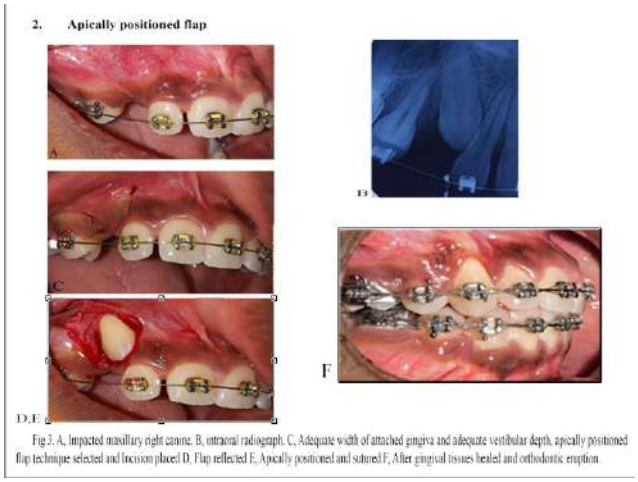


Fig 3. A, Impacted maxillary right canine. B, intraoral radiograph. C, Adequate width of attached gingiva and adequate vestibular depth, apically positioned flap technique selected and Incision placed D. Flap reflected E, Apically positioned and sutured F, After gingival tissues healed and orthodontic eruption

Fig 2 : Apically positioned flap - A, Impacted maxillary right canine. B, intraoral radiograph. C, Adequate width of attached gingiva and adequate vestibular depth, apically positioned flap technique selected and Incision placed D, Flap reflected E, Apically positioned and sutured F, After gingival tissues healed G, After the orthodontic eruption.

[Courtesy: Department of Orthodontics and Periodontics, Government Dental College, Trivandrum]

Closed Eruption Techniques[12]

Deep impaction is managed by elevating the flap following remove the hard tissue covering over the crown, brackets placed on the crown of impacted canine and flap sutured back to normal position.

Closed eruption and tunnel traction technique

If there is deciduous canine retained and permanent canine impacted, it can be managed by elevating the flap and remove the hard tissue covering over the crown, brackets placed on the crown of impacted canine and a tunnel is created in the buccal bone towards deciduous extraction socket and arch wire passing through the tunnel to reach the extraction orifice, and the flap sutured back to normal position.

Bracket placed by flap elevation and wire is passed through the deciduous canine extraction socket.

Modified window technique

Kokkich and Mathews states that surgical uncovering of palatally impacted canine should be done before starting an orthodontic treatment or

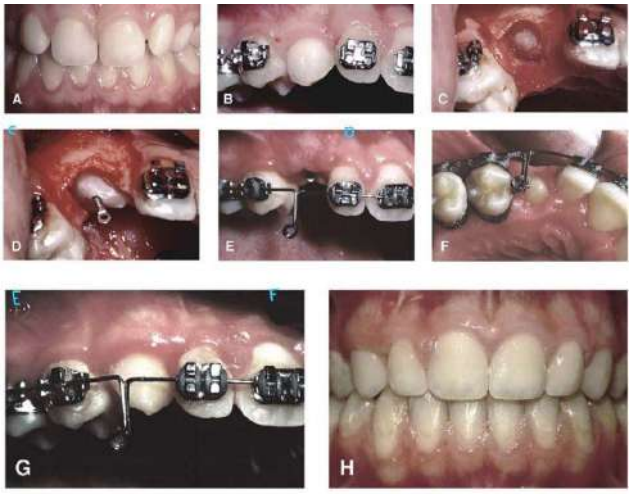


Fig 3 : Closed eruption technique - A, maxillary right canine impaction. B, During orthodontic treatment. C, Closed eruption technique used for canine exposure. D, Labial flap was elevated, and sufficient bone around the crown was removed to allow eruption without impinging on bone. E, F, and G, Ballista loop was used to erupt tooth into the center of the alveolar ridge. The Canine was then placed in its proper position in the arch. H, After orthodontic treatment.

during the late mixed dentition period. Elevating the mucoperiosteal flap, remove the bony covering to the level of cementoenamel junction and creating a hole in the palatal gingival flap after repositioning the elevated flap by suturing

Decision-Making Process

Labially positioned impacted canine

Periodontist should evaluate four criteria prior to surgical exposure of impacted maxillary canine.

- Evaluate the labiolingual position of the crown of impacted canine

If the tooth in Labial:- Uncovering by excision / Apically positioning the flap/ Closed eruption technique

If the tooth is impacted in the center of the alveolus:- Closed eruption techniques

- Asses the vertical positionof the impacted tooth with respect to the mucogingival junction.

If the vertical position of crown is coronal to mucogingival junction:- Uncovering by excision or Apically positioning the flap or Closed eruption technique any of the above technique can follow depending on the situation.

If the vertical position of crown is apical to mucogingival junction: - closed eruption technique

- Evaluate the width of attached gingiva on impacted canine region

Fig 4 : Closed eruption and tunnel technique - Bracket placed by flap elevation and wire is passed through the deciduous canine extraction socket.

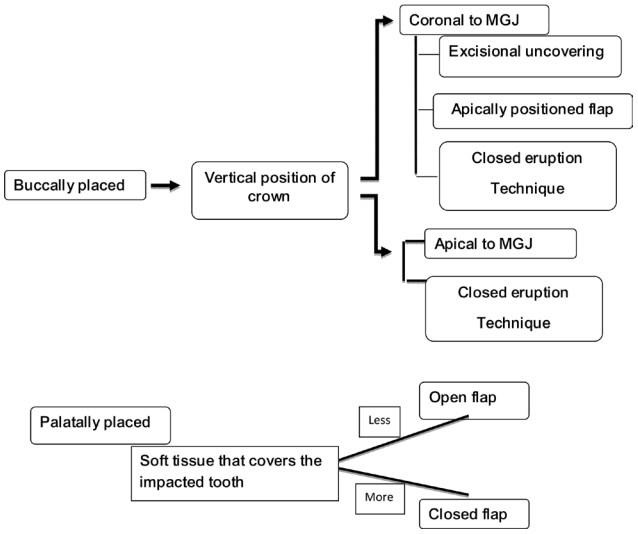
If the width of attached gingiva is inadequate: - the surgical technique should be employed to increase the width of the attached gingiva, like an apically positioned flap.

If the width of attached gingiva is adequate (at least 2-3mm):- surgical exposure can be done with uncovering by excision or Apically positioned flap or Closed eruption technique.

- Evaluate the position of crown mesiodistally.

Apically positioned flap advocated if the crown position is mesial and over the root of lateral incisor

Surgical Algorithm



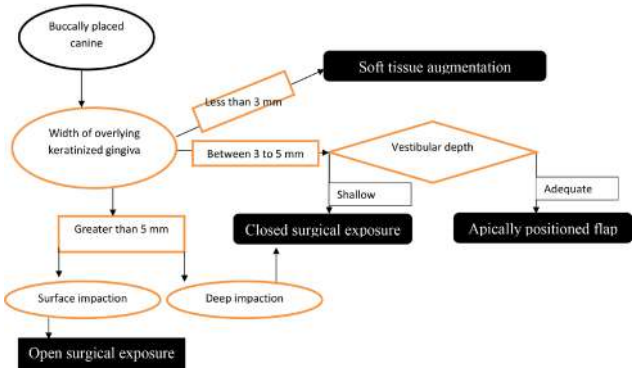
Surgical exposure from buccal approach

After evaluating the four criteria check the width of keratinized gingiva.

If the width of keratinized gingiva is less than 3 mm, first we have to do soft tissue augmentation and then coronally advance the flap with or without connective tissue graft[13] which is the best choice. Review the patient again and check the increase in width of keratinized gingiva.

If the overlying width of keratinized gingiva is 3–5 mm, check for vestibular depth. If it is adequate, surgical uncovering can be done with apically positioned flap as it increases the width of the attached gingiva. Closed surgical exposure is done in cases with shallow vestibule.

Finally, if the overlying width of keratinized gingiva is more than 5 mm, check the distance between crown and alveolar bone. if it is superficially placed impaction can be uncovered by excision or apically positioned flap. Deep impaction managed with closed eruption techniques.



Conclusion

Canine is the most common impacted anterior teeth that has a major role in occlusion, smile, and aesthetics. Surgical exposure if not properly done can lead to an unacceptable outcome in terms of aesthetics and orthodontic eruption.

Excisional uncovering, apically positioned flap, and closed eruption are the most commonly employed techniques for canine exposure. The width of keratinized gingiva determines the selection of technique in the buccal approach.

Four criteria determine the selection of technique for surgical exposure 1, Labiolingual position of crown of impacted canine 2, Vertical position of the tooth in relation to mucogingival junction 3, Presence of keratinized gingiva in the impacted canine area 4, mesiodistal position of crown of canine.

Management of impacted canines is a complex procedure. There should be proper communication between the clinician who deals with the patient so that they can come to a optimal treatment plan based on the various factors. Following the surgical algorithm, for surgical exposure of canine help in reducing orthodontic challenges related to the management of impacted canine in the dental arch.

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JSPIK

Dental stains: The truth unravelled

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ABSTRACT

Dental stains are the pigmented deposits on the surface of the tooth. They maybe intrinsic or extrinsic in nature. Stains compromise the aesthetics of an individual.In order to plan an appropriate treatment for tooth discolouration it is mandatory to have a proper understanding on the etiology and the degree of adherence of stains on the tooth surface. The purpose of this article is to review the literature on the causes of tooth staining and discolouration and the treatment modalities available.

Keywords: extrinsic stains, intrinsic stains, over-the counter products, professional tooth cleaning

Introduction

The modern era seeking dental treatment is concerned with the colour of the dentition. In order to enable a correct diagnosis when examining discoloured dentition, the clinician should have a proper understanding on the etiology, composition, severity and degree of adherence of different stains. Detailed clinical examination and a thorough history on the oral hygiene practices, dietary habits, history of exposure to chemicals, trauma and infection are essential in making a final diagnosis.

Types of Discoloration

Discoloration is classified as extrinsic, intrinsic or a combination of both.

Extrinsic stains are caused by extrinsic agents and are located on the outer surface of the teeth or on the acquired pellicle. Intrinsic stains result from the incorporation of pigmented materials into the dental tissues.

1. Extrinsic Stains

Extrinsic stains can be identified by color, distribution, and tenaciousness. They are classified as: brown stain, tobacco stain, black stain, green stain, orange stain, metallic stain, antiseptic stains

Brown stains-Brown stain is a thin, bacteria-free, pigmented pellicle found most commonly on the buccal surface of the maxillary molars and on the lingual surface of the mandibular incisors.

- Predisposing factors: insufficient brushing, inadequate cleansing action of dentifrice, chromogenic bacteria.

Tobacco stain- Tenacious dark-brown or black discoloration covering the cervical onethird to one-half of most teeth and commonly is found in enamel defects. Staining results from deposition of coal tar products on the tooth surface, and it may penetrate enamel.

- Predisposing factor: Tobacco chewing

Black stain-occurs as a thin black line or as wide band on the facial and lingual surfaces of the teeth

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near the gingival margin and extends on the proximal surfaces. They are common on pits and fissures.

• Predisposing factor: penetration of pits and fissures by tobacco juices, exposure to iron, manganese, silver.

Green stain - Tenacious thick deposit usually found as a band on the labial surface of the maxillary anterior teeth at the gingival third. This type of stain is considered as stained remnants of enamel cuticles. The discoloration has been attributed to fluorescent bacteria and fungi such as Penicillium and Aspergillus. They grow only where there is light and therefore stain the maxillary anterior teeth.

• Predisposing factors: Fluorescent bacteria-Penicillium, Fungi-Aspergillus, associated in children with T. B. or cervical lymph node, Copper salts in mouth rinse (Manuel et al., 2010), exposure to copper and nickel in the environment in factory workers.

Orange stain-Less common than green or brown stains, occurring in approximately 3% of the populatiom It occurs on the labial surface of maxillary and mandibular anterior teeth at the cervical margin or at the gingival third. It is more easily removed than green stain and often is associated with poor oral hygiene.

• Predisposing factors: exposure to chromic acid fumes in industrial workers.

Metallic stains- The metals combine with acquired pellicle to produce a surface stain, or penetrate the tooth substance to cause permanent discoloration.

Some metals that cause stains: Copper dust-Green stain, Iron dust-Brown stain, Magnesium-Black stain, Silver- Black stain, Iodine-Black stain, Nickel-Green stain.

• Predisposing factors: introduction of metals into oral cavity, metal containing dust inhalation by worker, oral administration of drugs.

Chlorhexidine stains: Chlorhexidineis adsorbed onto the tooth surface and mucous membrane by the binding of the positively charged chlorhexidine molecule to the negatively charged oral and dental surfaces and is slowly released in an active form by cations, such as calcium in plaque and saliva. The yellowish brown stains produced by Chlorhexidine are not permanent in nature. It can be removed with proper brushing with dentifrice.

Lower concentrations of Chlorhexidine (0. 12%) will decrease side effects, since higher concentrations do not seem to be more effective in controlling dental plaque and gingivitis. (Najafi et al 2012).

Treatment of Extrinsic Stains

• Prior to the treatment, thorough dental and medical histories must be recorded including the intake of drugs and oral therapeutic agents.

• Occupational exposure to chemicals, oral hygiene practice, and habitual beverage consumption should be explored.

• Careful be examination of the tooth should be performed in order to identify the position and distribution of the stain, enamel roughness and defect, caries or defective restoration, and plaque and calculus deposition.

• After identifying the causative factor for discolouration, proper communication with the patient is utmost important.

Immediate therapy

1. Advice on correct toothbrushing technique, using a dentifrice with sufficiently high cleaning and polishing power, or dentifrices, containing chelating agents, such as sodium citrate and citric acid, and proteolytic enzyme.

2. Meswak, a wooden toothbrush or chewing stick used in some Afro-Asian communities, is an efficient tool for the cleaning of teeth, because it contains a high amount of abrasive silica and calcium phosphate salts.

3. For dietary sources of stains, the patient should be advised to reduce the intake of staininducing beverages (e. g., coffee and tea) and encouraged to brush the teeth immediately after consumption.

4. Workers exposed to industrial chemicals should wear a mask.

5. Many extrinsic stains are simply removed by toothbrushing with dentifrice or professional prophylaxis. Any calculus deposition should be removed prior to pumicing. A roughened enamel surface may be polished with fine polishing paste

and superfine aluminum oxide polishing disks. Experiments indicate that application of pumice and water slurry with a rotating rubber cup for 30 seconds removes about a 3-micron thick enamel layer.

6. For more stubborn discoloration defects, enamel micro abrasion (hydrochloric acid and pumice abrasion) or home bleaching technique should be attempted.

Over-the-counter products

Three types of whitening toothpastes are manufactured. All toothpastes, however, contain some abrasives and are capable of potentially removing stains whether they are labeled "whitening" or not. Toothpastes with a high content of abrasives should not be recommended for daily use. Secondly, the newer whitening toothpastes contain a bleaching agent, such as peroxide, but the Council on Scientific Affairs of the American Dental Association (ADA) does not recommend them for long term use (Hosoya and Johnston, 1989). Lastly, cosmetic toothpastes, containing titanium dioxide, cover extrinsic stains like paint covers a wall and do not change the internal tooth color.

Professional tooth cleaning

Some extrinsic stains may be removed with ultrasonic cleaning, rotary polishing with an abrasive prophylactic paste, or air-jet polishing with an abrasive powder (Weaks et al., 1984). However, these modalities can lead to enamel removal; therefore, their repeated use is undesirable (Croll, 1977).

Ultrasonic and sonic scalers: The small, quick vibrations in combination with a water flow give us a whole new level of effectiveness in removal of deposits on the tooth surface. The benefits of ultrasonic scaling include increased efficiency of stains and calculus removal and less need for hand scaling.

Selective polishing

Selective polishing involves polishing only the areas of stains. In this procedure, the dental auxiliary can select specific teeth to be polished using a prophylactic angle and rubber cup with a fine paste, and can brush the remaining teeth with a toothbrush to remove bacterial biofilm on tooth surfaces. According to the American Academy of Periodontology (2000) and other sources (Mellberg, 1979), polishing for approximately 30 sec with a prophylactic paste containing pumice can remove between 0.6 μm and 4 μm of the outer enamel. The outer surface of the enamel contains a natural component of fluoride, with the highest amount of fluoride concentrated on its surface. When using a prophylactic angle with a prophylactic cup on this enamel-rich surface, the dental assistant may not only remove the fluoride layer, but also introduce a rough surface and/or scratches on the tooth surface, which can contribute to the further

Table 1: Causes of generalized intrinsic tooth discolouration

ENVIRONMENTAL		HEREDITARY	
Prenatal	Postnatal	Tooth only	Accompanied by systemic Disorder
a) Maternal infection (Rubella, Cytomegalovirus) b) Maternal drug therapy (Tetracycline) c)Pregnancy toxemia	a) Infection (Measles, Chickenpox, Scarlet fever) b)Drugs (Tetracycline, Fluoride) c)Nutritional deficiencies Hematopoietic disorders (Erythroblastosis fetalis, Thalassemia)	a)Amelogenesis Imperfecta b)Dentinogenesis Imperfecta c)Dentin dysplasia	a) Epidermolysis Bullosa b) Erythropoetic Porphyria c) Osteogenesis Imperfecta

harboring of bacteria on these surfaces.

Prophylactic pastes- Prophylaxis polishing agents are available in two basic forms: dry powders, also referred to as flours that must be mixed with a liquid (water, fluoride, or mouth rinse) and commercially prepared polishing pastes that are available in bulk or individual unit doses. The use of dry abrasives or powder on a dry polishing cup is contraindicated due to the potential for thermal injury to natural teeth. The grit of commercially prepared polishing pastes is graded from fine to coarse, based on a standard sieve through which the particles pass (Wilkins, 2009). The types of abrasive particles used in polishing pastes vary among the commercial varieties and from one grit size to another, yet there is no industry standard to define what these terms mean or what size the abrasive particle must be. The types of abrasive particles used in commercial prophylaxis polishing pastes include flour of pumice, aluminum oxide, silicon carbide, aluminum silicate, silicon dioxide, carbide compounds, garnet, feldspar, zirconium silicate, zirconium oxide, boron, and calcium carbonate (Wilkins, 2009).

2. Intrinsic Discoloration

Unlike extrinsic discolorations that occur on teeth surfaces, intrinsic stains are attributable to incorporation of chromogenic materials into enamel and dentin either before eruption (during odontogenesis) or after eruption. A number of metabolic diseases and systemic factors are known to affect the developing dentition and cause discoloration.

Trauma-related stains result from blood breakdown products that have seeped from the traumatized area into the area of mineralization during enamel formation of the permanent tooth. Severe trauma to erupted teeth can cause hemorrhage in the pulp chamber owing to rupture of blood vessels. This blood is driven into the dentinal tubules and the red blood cells undergohemolysis, releasing hemoglobin.

Trauma or infection affecting a primary tooth may result in enamel opacities or hypoplasia of the permanent successor.

Discoloration related to improper endodontic treatment may be caused by trauma inflicted during pulp extirpation, failure to remove all pulp remnants, owing to inadequate access, or incomplete obturation of the pulp chamber.

Application of excessive and poorly controlled orthodontic forces would sever the blood vessels entering the pulp canal, resulting in loss of tooth vitality and intrinsic discoloration.

Dental materials can discolor the dentition. Corrosion products from amalgam restoration discolor the teeth by the formation of silver sulfide, a grayish-black stain that can reflect through the enamel.

Dental fluorosis is the most common cause of intrinsic tooth discoloration because it is endemic in areas with above-optimal fluoride concentration in drinking water and because of the availability of fluoride from multiple sources. Depending on severity, the clinical appearance of dental fluorosis can range from delicate accentuation of the perikymata pattern to white opaque spots or streaks, brown pitting patches, or almost complete loss of the most external parts of enamel.

Tetracycline staining first was reported in the mid-l950s, less than a decade after the introduction and widespread use of this antibiotic. In 1963, the United States Food and Drug Administration issued a warning about the use of such antibiotics for pregnant women and young children. Teeth are most susceptible to tetracycline discoloration during their formation (i. e., between the second trimester in utero and approximately 8 years of age). Prolonged tetracycline therapy also can stain the fingernails at all ages. Deposition of tetracyclines in the skeleton of the human fetus may depress bone Similarly, hypoplasia of dentin and enamel may occur if large amounts of tetracycline are ingested during development (calcification) of the deciduous and permanent dentition.

Hemolytic diseases of the newborn previously called erythroblastosis fetalis and icterus gravis neonatorum, may produce severe jaundice in the newborn, resulting in yellow green discoloration and enamel hypoplasia of the primary teeth. The cause of this discoloration is the incorporation of bilirubin in the developing dentition. Sickle cell anemia and thalassemia may result in similar discoloration, owing to the presence of blood pigments within the dentinal tubules. In erythropoietic porphyria, the deposition of porphyrin pigments in dentin and bone, make primary

and permanent teeth appear purplish-red or reddish-brown in color. In this condition the affected teeth will fluoresce red with ultraviolet light.

Enamel hypoplasia is incomplete or defective formation of enamel matrix characterized by a break in enamel surface and manifested clinically as pits, grooves, or partial to total absence of enamel. Enamel opacity is a qualitative defect of enamel mineralization (hypocalcification), manifest as changes in translucency (white, opaque, or discolored area) that may be demarcated or diffuse, but there is no clear boundary with the adjacent normal enamel.

Treatment of Intrinsic Stains

Intrinsic discolorations occur within enamel or dentin and, therefore, are more difficult to treat than external stains, which occur on the tooth surface. Intrinsic stains can affect vital or nonvital teeth as well as endodontically treated teeth. Major advances in the past decade have been focused on better bleaching agents and new ways to enhance the diffusion of the bleaching agent.

Different types of intrinsic stains require different approaches for removal, according to location and etiology of the stain. In general, surface enamel stains can be treated using enamel micro abrasion whereas deeper internal stains can be removed by bleaching techniques.

Enamel Micro abrasion: Micro abrasion involves enamel surface dissolution by hydrochloric acid along with the abrasiveness of pumice to remove superficial stains or defects. This is a simple, quick, and safe technique that has been employed successfully to treat brown fluorosis stain, white opacities, and staining and decalcification following orthodontic therapy.

Conclusion

Tooth discoloration is a frequent dental findingassociated with clinical and esthetic problems. It differs in etiology, appearance, composition, location and severity. Knowledge of the etiology of tooth staining is of importance to dental surgeons in order to enable a correct diagnosis to be made when examining a discolored dentition and allows the dental practitioner to explain to the patient the exact nature of the condition. In some instances, the mechanism of staining may have an effect on the outcome of treatment and influence the treatment options the dentist will be able to offer to patients. Dental auxiliaries must use good judgment when considering coronal polishing and practice preventive procedures as the standard of care, which means that treatment must be individualized.

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Fair and lovely of gingival esthetics- gingival depigmentation: A case series

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ABSTRACT

Background: Gingival health and colour are essential components for a charming smile. Gingival pigmentation occurs in all human races and varies from one race to another.Gingival pigmentation is a common aesthetic concern for patients, particularly in case of patients with gummy smile.Although hyperpigmentation of gingiva is not a medical problem, it can cause psychological disturbances in few patients. Various surgical techniques have been proposed for depigmentation, but the healing result differs for each procedure.

Materials and methods: In the current case series, four cases of unaesthetic gingival pigmentation are reported which were treated using two different techniques i.e., scalpel and ceramic soft tissue trimmer. And the pain perception was evaluated using visual analogue scale (VAS) score obtained from the patients postoperatively.

Results: Both techniques achieved satisfactory aesthetic results on visual examination. However the postoperative discomfort was lesser when soft tissue trimmer was used than with scalpel technique.

Keywords: gingiva, depigmentation, scalpel, ceramic soft tissue trimmer

Introduction

A gorgeous smile enhances the self-confidence of the individual. For an attractive smile along with the shape, colour and position of the teeth, health and colour of the gingiva plays a vital role.[1] The colour of Gingiva depends upon the number and size of the vasculature, thickness of the epithelium, degree of keratinisation and pigments present in the gingival epithelium.[2] Melanin is a endogenous pigment which are produced by melanocytes present in the basal and suprabasal cell layer of epithelium.[3] As early as 3 hours after birth, melanin pigmentation appears in oral tissues, and in some cases, this is the only sign of pigmentation in the body. In general, it is believed that only when melanin particles synthesized by melanocytes are transferred to keratinocytes pigmentations are visible intraorally. This close relationship is called the "epidermal melanin unit".[4] The melanin pigmentation can be removed by performing a simple de-epithelization procedure called as gingival depigmentation. Various gingival depigmentation techniques are Scalpel surgical technique, Bur abrasion method, Electro-surgery, Cryosurgery, lasers, radiosurgery, chemical methods, free gingival graft, acellular dermal matrix allograft.[5]

The aim of this case series is to evaluate the efficacy of two different depigmentation techniques i.e. scalpel technique and ceramic soft tissue trimmer technique.

Materials and Methods

Four patients with chief complaint of unaesthetic

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gingival pigmentation, who had healthy gingiva and the without any systemic diseases were included in the present case series. Two different gingival depigmentation techniques were used namely scalpel and ceramic soft tissue trimmer. Dummett oral pigmentation index (DOPI) given by Dummett and Gupta (1964)[6] was used to record the intensity of pigmentation. Scoring criteria were O= No pigmentation, 1 = Mild pigmentation, 2= Moderate pigmentation, 3= Heavy clinical pigmentation. The pain perception of the patients was recorded using visual analogue scale (VAS) which is a numerical scale of 10cm long horizontal line that is anchored at the left end by the descriptor of "no pain" and at the right end by the descriptor "worst pain" shown in the figure 1.

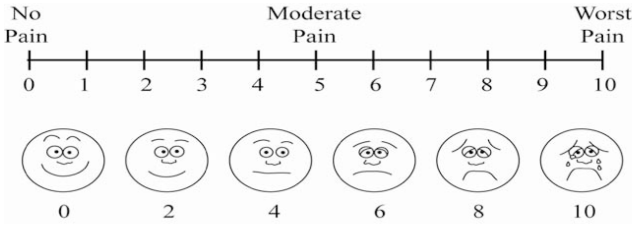

Fig 1: visual analogue scale

Case 1:

A male patient aged 24 years, reported with the chiefcomplaint of black gums. On clinical examination,

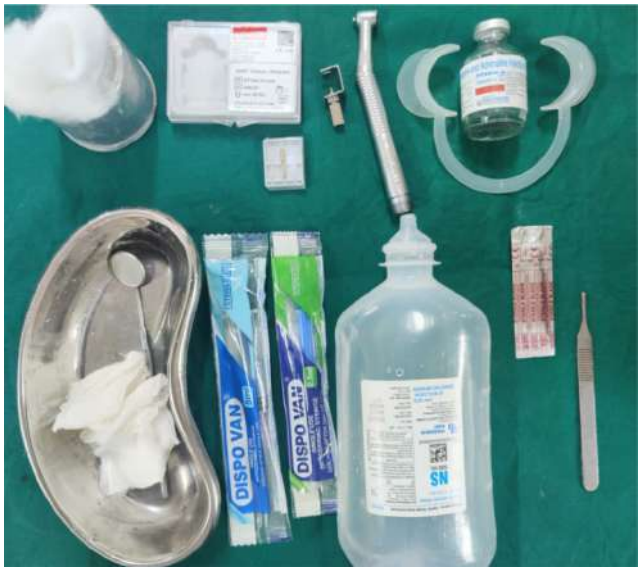

Fig 2: Armamentarium

Fig. 3a. Pre-operative view

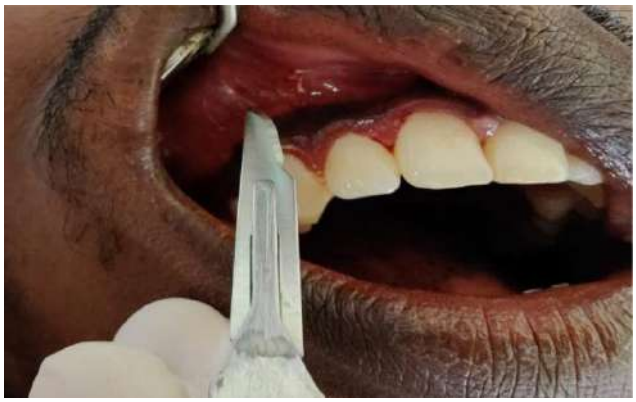

Fig. 3b. intra-operative view

Fig. 3c. Immediate post-operative view

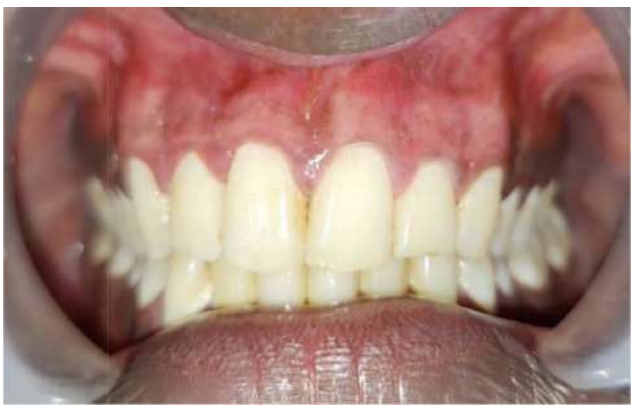

Fig. 3d. 1month follow up

the gingiva revealed heavy pigmentation in maxillary anterior gingiva from canine to canine in the form of a band extending from marginal gingiva to mucogingival junction with a Dummet score of 3.[6] Medical history was non-contributory. Depigmentation was planned using a scalpel. The patient was explained the procedure and consent was taken prior to the procedure.

Procedure

Following local infiltration with anaesthetic solution (2% lignocaine with 1:80,000 adrenaline) in maxillary anterior region (from 13 to 23) depigmentation was performed by scraping the pigmented epithelium along with the layer of connective tissue with surgical blade no 15, and the remnants were removed with sterile guaze. Digital pressure was applied with a sterile gauze to control bleeding. Saline irrigation was done. Patient was prescribed a topical medication containing lidocaine, chlorhexidine gluconate & metronidazole (quadrajel®). Patient was reviewed after 7days. Patient reported mild pain for 2 days after the treatment (VAS score=3) which subsided later. One month postoperative assessment of these patients showed no recurrence of gingival pigmentation.

Case 2:

A 26 year old female patient, reported with a chief complaint of black coloured gums which made her smile "unpleasant". On intra oral examination, the gingiva showed heavy pigmentation with a Dummet score of 3.[6] Depigmentation was planned for this patient with the help of scalpel. Treatment protocol and post operative medicaments and instructions was the same as that of case 1. Patient was reviewed after 7 days. Patient reported mild pain for 2-3 days after the treatment (VAS score =3) which was subsided later. One month postoperative assessment of these patients showed no recurrence of gingival pigmentation

Case 3:

A 22 year oldfemale patient, reported with a chief complaint of dark coloured gums that were visible on smiling. On intra oral examination, the gingival mucosa shows heavy pigmentation with a Dummet score of 3. 6Depigmentation was planned for this patient with the help of ceramic soft tissue trimmer.

Procedure

Following local infiltration with anaesthetic solution (2% lignocaine with 1:80, 000 adrenaline) inmaxillary anterior region (from 13 to 23), Soft tissue trimmer was used in the high-speed handpiece with speed of 2,00,000rpm without the use of water coolant spray to excise and contour soft gingival tissue. Water was avoided, as bur heats up the tissue due to friction, which results in immediate tissue coagulation

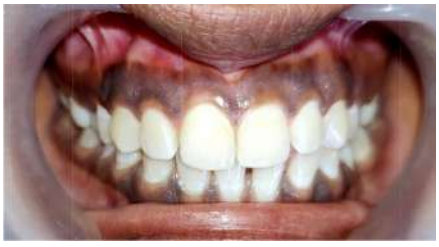

Fig. 4a. pre-operative view

Fig. 4b. post-operative view

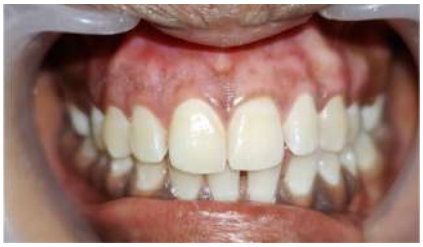

Fig. 4c. 1 month follow up

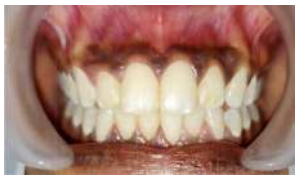

Fig. 5a. Pre-operative view

Fig. 5b. Intra-operative view

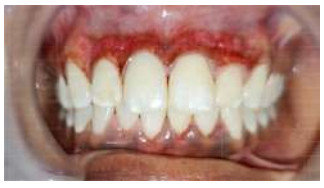

Fig. 5c. post-operative view

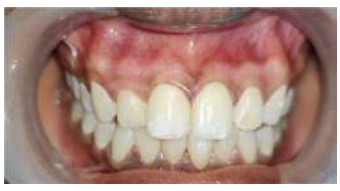

Fig. 5d. 1 month follow up

and minimal bleeding. After removing the entire pigmented epithelium from 13-23, the exposed surface was irrigated with saline. Care was taken to see that all remnants of the pigment layer were removed with the guaze. Patient was prescribed a topical medication (quadrajel®). Patient was reviewed after 7 days. Patient had no pain following the treatment (VAS score =0). One month postoperative assessment of these patients showed no recurrence of gingival pigmentation.

Case 4:

A 20 year old male patient, reported with a chief complaint of dark coloured gums. On intra oral examination, the gingival mucosa shows heavy pigmentation with a Dummet score of 3.[6] Depigmentation was planned for this patient with the help of ceramic soft tissue trimmer. Treatment protocol was the same as case 3. Patient was reviewed after 7 days. Patient had no pain following the treatment (VAS score =0). One month postoperative assessment of these patients showed no recurrence of gingival pigmentation.

Discussion

Melanin is a black pigment, most common natural pigment that causes endogenous pigmentation. The severity of it varies with the activity of the melanoblast.[7] The choice of depigmentation technique should be based on clinical experience, personal preference and patients affordability.[8] The present case series is done to compare the pain perception of patients with two depigmentation techniques namely scalpel techique & ceramic gingival soft tissue trimmer technique.

Scalpel surgical technique is also called as split thickness epithelial excision[9] and surgical stripping.[10] Traditional scalpel method involves surgical excision of gingival epithelium and a layer of connective tissue and allowed to heals by secondary intension.[11] This is the simple, cheapest and commonest method to perform with least amount of time, effort and instruments.[12] Although lower cost and lower recurrence rate are conducive to surgical excision of gingival, it is associated with pain, discomfort and bleeding.[13] Thinner gingival biotype and narrow papillary area prohibit the use of this technique.[14]

Soft tissue trimmer is made of ceramic composed of zircon-dioxide stabilized by yittrium and aluminium ceramic. It can ensure a good and smooth cut, while the heat generation by the bur would produce a good hemostatic effect, minimise the bleeding and almost eliminate the risk of necrosis. It can be disinfected by any method upto the temperature of 135°C. 15In this technique, less bleeding and immediate tissue coagulation were observed . This is due to the thermal coagulation effect of the heat generated by the bur. The pain index is also very low, when compared to scalpel technique, because the ceramic bur removes only the superficial epithelial surface, and does not involve the underlying lamina propria containing nerve ending. Visual analog scale (VAS) was used to assess the pain severity after the procedure. The patient made a mark that corresponded to his or her pain level.[16] VAS was obtained from all the patients on the recall visit on the 7th day.

In our study patients treated using ceramic soft tissue trimmer showed less pain experience compared to the scalpel technique, similar to the results shown by

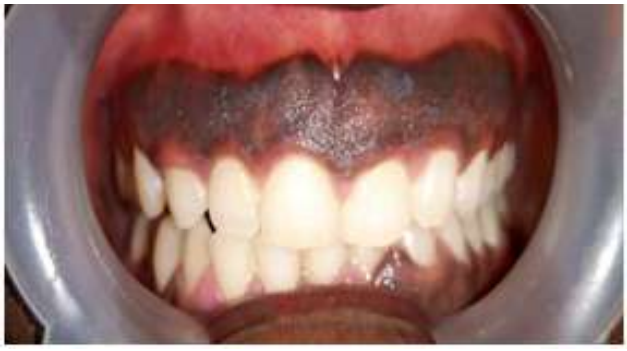

Fig. 6a. Pre-operative view

Fig. 6b. Post-operative view

Negi R et al 2019.[17] Similar results were also seen in the study done by Goldar k et al 2020.[15] However, more studies with long-term follow-up of the procedure is needed to confirm that ceramic trimmers are the better alternative to scalpel technique.

Conclusion

The traditional use of scalpel for gingival depigmentationis a widely used technique forcorrection of gingival hyperpigmentation. Gingival depigmentation using scalpel method has an advantage of being effective and it requires minimum time and effort with the lowest rate of re-pigmentation comparedto LASER and abrasion methods.[18] On the other hand use of soft tissue trimmer has gained attention in recent days due to its advantages such as low cost, less technique sensitive and less time consuming. In our case series patient treated with soft tissue trimmer technique showed better compliance and less post operative discomfort than with scalpel technique. There is however, scarce literature on the use of soft tissue trimmers and long term follow up studies have to be done to assess the efficacy of this technique.

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Platelet Concentrates: Panacea of periodontal regeneration

Nivetha R.[1], Vishnu P.[2], Esther Nalini H.[3], Arun Kumar Prasad P.[4], Renuka Devi R[5]

ABSTRACT

Periodontitis is a chronic inflammatory disease affecting supporting structures of the tooth such as alveolar bone, PDL and cementum results in loss of tooth. Periodontal regeneration of lost supporting structures gives a greater challenge in clinical research to regulate inflammation and increase speed of healing process which involves cellular organization, chemical signaling, extracellular matrix and growth factors for tissue repair. In this sense, development of natural bioactive surgical additives likes PRF; PRP appears as a satisfactory alternative for regeneration which gives favorable and low risks results. The following review attempts to summarize regarding the techniques of preparing PRF, PRP and various types of PRF preparation methods for clinical application.

Keywords: Periodontitis, PRF, PRP, Regeneration and Repair

Introduction

Periodontitis is achronic inflammatory disease of the periodontium that leads to loss of tooth supporting tissues. Following periodontal therapy, healing occurs by regeneration, repair or a combination of both. The healing process depends on the availability of cell types needed and signalling cascades that regulate stimulation of these cells. The natural wound healing cascade is commenced by clot formation accompanied by proliferative and maturation phases. Several growth factors are released into tissues from platelets. Growth factors also aid in wound healing by favouring mitogenesis, chemotaxis, and angiogenesis.[1]

Platelets Morphology

Platelets are small irregularly shaped cells present in blood that are derived from precursor megakaryocytes. They are approximately 2–3 μm in diameter, and constitute granules, few mitochondria, and prominent membrane structures. The canalicular system and a wellstacked tubular system on the cell surface helps in expulsion of growth factors upon platelet activation.

The substances located in αgranule, dense granules, and lysosomes of platelets modulate its activation. Of which, the most abundant ones are α-granules that contains many bioactive mediators. During tissue injury, the platelets get activated and release wound healing factors like PDGF, VEGF, TGF and EGF. As platelets contain biologically active proteins, they create a chemotactic gradient for recruitment of stem cells which undergoes differentiation and may promote healing by regeneration. Hence, autologous platelet concentrates have a promising scope in periodontal regeneration[2].

History of Platelet Concentrates

The first platelet product used as a surgical adjuvant was the "Fibrin glue" by Matras in 1970 that improved skin wound healing in rat models.

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The regenerative potential of platelets was initially introduced in 1974 by Ross et al and in 1986, Knighton et al, termed platelet concentrates as "plateletderived wound healing factors" as they promoted healing when used for skin ulcers. In 1998, Marx et al introduced the first generation of platelet concentrates known as platelet rich plasma (PRP) and in 2000; Choukroun et al introduced the "secondgeneration" of platelet concentrate known as platelet rich fibrin (PRF).

The concept of concentrated growth factors (CGF) was introduced by Sacco in 2006 which were found to be rich and dense fibrin blocks. The first classification on platelet concentrates was proposed by DohanEhrenfest et al in 2009 based on 2 key parameters that is, presence of cell content (mostly leukocytes) and the fibrin architecture. This classification included 4 main families of products: P-PRP, L-PRP, P-PRF and L-PRF. Subsequently Sohn introduced the concept of sticky bone in 2010. Recently, certain modifications of platelet rich fibrin were introduced. These were the advanced platelet rich fibrin (A-PRF) introduced by Choukroun in 2014, Titanium prepared platelet rich fibrin (T-PRF) by Tunali et al and injectable PRF (i-PRF) by Mourão et al in 2015[3].

1 Platelet Rich Plasma: (First generation of platelet concentrates)

Whitman (1997) and Marx (1998) were introduced the use of PRP for oral and maxilla facial surgery. PRP is an increased concentration of platelets in a small amount of plasma that is obtained after centrifugation. PRP classified based on leukocyte content such as P-PRP (without leukocytes and low density fibrin) and L-PRP (with leukocytes and low density fibrin).

Preparation

27mL of blood collected in a syringe containing anticoagulant (adenosine citrate dextrose acid) and is transferred to a separation tube to centrifuge at 1900g for 15minutes at room temperature. We get three layers, first layer – PPP which is discarded, second layer – buffy coat (collected in a separate syringe) and third layer – RBC discarded. Now, 11mL of blood collected in a syringe containing 1mL of ACD-A anticoagulant and transferred in to a clotalyst tube containing 4mL of thrombin. Content is gently mixed and kept in an incubator for 25minutes and centrifuged at 1900g for 5 minutes. Collect that content in a separate syringe and mix with buffy coat to form a clot. Time for clinical use after centrifuging will be 45minutes. PRP can be used for osteoarthritis, extraction socket, periodontal intra bony defects, in sinus elevation, hard and soft tissue augmentation procedures. PRP helps to accelerate the vascularization of the graft, improve soft tissue healing and bone regeneration and reduce postoperative morbidity. PRP also as certain disadvantages like preparation protocol expensive and complicated, use animal thrombin as a coagulant raises legal issues[4, 11].

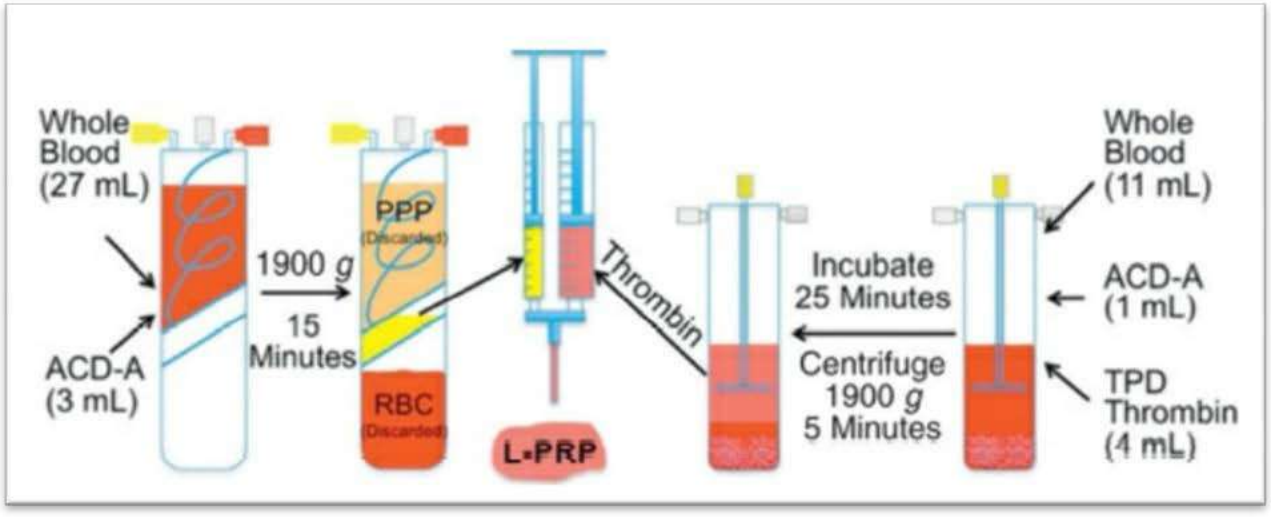

Fig 1: Preparation of PRP

2 Platelet Rich Fibrin: (Second generation of platelet concentrates)

To overcome disadvantages of PRP, Choukroun and coworkers introduced PRF in 2001. Based on leukocyte content PRF classified into two,

- L-PRF (90% of platelets and 75% of leukocytes with high density network).
- P-PRF (Pure-platelet rich fibrin without leukocytes with high density network).

Preparation

9-10mL of blood collected in a sterile glass or plastic tube and centrifuged within seconds 60 seconds after the start of venipuncture at 3000rpm for 12minutes (PRF) and for L-PRF 2700 rpm for 12 minutes. Patient under anticoagulant therapy centrifuge for about 15 to 18 minutes is recommended.

When theblood without anticoagulant poured in to the plastic tube coated with silica and silicon which helps to activate coagulation naturally. Within few minutes coagulation cascade gets activated, initially fibrinogen presented in upper layer, after centrifugation due to the activation of autologous thrombin, it is converted into fibrinogen to fibrin clot.

End of centrifuging, three layers can be seen (Fig 3). Middle part is L-PRF clot can be removed from the tube with surgical tweezers. RBC fraction can be gently separated from the fibrin clot. This clot contain greater amount of exudate and growth factor. Place clot in Xpression kit for gentle compression for about 5minute. 1mm thick L-PRF membrane can be obtained and it stays stable for about 2 hours but it should be prevented from drying out. For L-PRF plug, place clot in metal Xpression cylinders press with the piston to compress the clot. Fibrin matrix rich in 90% of platelets, 65% of leukocytes, growth factors such as PDGF, VEGF and TGF and also fibrin, fibronectin, vitronectin and thrombospondin[5].

Table 1 : General characteristics of leukocyte membrane

Platelets	• 90% of platelets mainly seen in border between fibrin clot and RBC, also called as "face" which are biologically active. • Platelets cytoplasm contains granules. These granules mainly contain cytokines and many active substances like serotonin, von willebrand factors, factor V, osteonectin and anti-microbial peptides. • Platelet can bind with broken blood vessels and gets activated for aggregation and hemostasis. Role homeostasis by clearing pathogens from the bloodstream and participate in antibody dependent cell cytotoxicity function to kill pathogens and release antimicrobial peptides.
Leukocytes	• Dohan analyzed > 50% and KU Leuven confirmed >75% of leukocyte in fibrin matrix.They can regulate cell proliferation and differentiation, wound healing and first cell in neoangiogenesis. They contain VEGF which act as potent vascular GF.

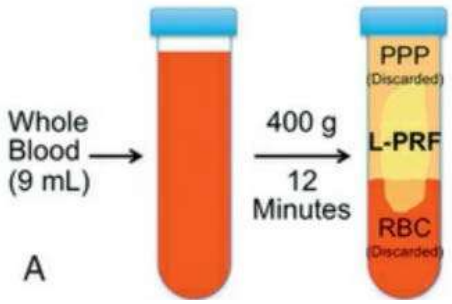

Fig 2: Preparation of PRF

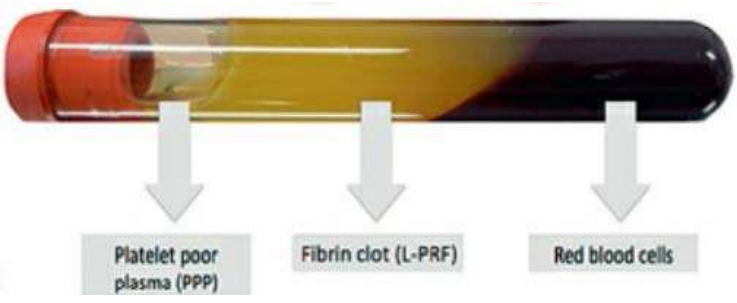

Fig 3: Upper, middle and lower layer

Growth Factors	• Platelets has alpha granules in cytoplasm which releases GF such as PDGF, IGF, EGF, VEGF and TGF-β helps in initiation of wound healing by activating and attracting macrophages, fibroblast and endothelial cells. • GF in PRF releases up to >7 days due to activation by intrinsic GF enmeshment whereas, in PRP release up to only for <3 days due activation by extrinsic GF enmeshment.
Fibrin	• Fibrinogen in converted into fibrin by presence of thrombin to form insoluble clotting protein. When it binds with platelets results in formation of long, nonsoluble strands. This fibrin wires get polymerized to form fine and flexible network. • Matrix favors high affinity for circulating peptides (cytokines), helps in cell migration and healing process and also capture glycosaminoglycans (originating from platelets).
Stem Cells	• In vitro studies done by Dohan, concluded that human bone Mesenchymal stem cells get stimulated when it come in contact with L-PRF.

3 Injectable – Platelet Rich Fibrin (I-PRF):

I-PRF is a liquid form of platelet concentrate can be used alone or along with other biomaterials. It has higher form of cells and GF compared to other form of PRF. It also attains gel form after about 10 to 15 minutes for sustained release of GF into the tissues. I-PRF also used to increase thickness of thin gingival phenotype[1, 6].

Preparation

10 mL of blood collected without anti-coagulants and centrifuged at 700rpm for 3 minutes at room temperature. The upper liquid is collected as I-PRF.

4 Advanced Platelet Rich Fibrin (A-PRF):

A-PRF provides the defect not only with a matrix that permits cell migration into the defected area but also provides important biological factors that accelerates wound-healing such as PDGF, TGF-β, PF4, IL1, VEGF, epidermal growth factor, ECGF, PDEGF, insulin-like growth factor, osteocalcin, osteonectin, fibrinogen, vitronectin, fibronectin, and thrombospondin. A-PRF showed better results for gingival recession treatment compared to L-PRF[3, 5].

Preparation

10 mL of blood collected without anti-coagulants and centrifuged at 1500rpm for 14 minutes at room temperature. Middle fibrin clot collected as A-PRF which showed greater release of PDGF-AA followed by PDGF-BB, TGFB1, VEGF, and PDGF-AB over a period of 10 days.

5 Titanium-Prepared Platelet Rich Fibrin: (T-PRF)

Tunali et al 2004 introduced T-PRF that as more efficient in activating platelets compared to silica present in glass tube. To overcome silica related hazards O'Connell reported titanium coated tubes are more efficient in preparing PRF.

Preparation

10mL of blood drawn into sterile titanium tube without anti-coagulant and centrifuged at 2800rpm for 12 minutes. The middle fibrin clot separated from the RBC act as T-PRF[12].

6 Concentrated Growth Factors: (CGF)

CGF preparation yields denser and larger fibrin matrix rich in GF.

Preparation

10mL of blood collected in centrifuge tube without anti-coagulant and accelerated for 30sec followed by centrifuging 2700 rpm for 4 minutes, 2400 rpm for 4 minutes, 2700 rpm for 4 minutes and 300 rpm for 3 minutes and decelerated for 36 seconds to stop. Obtained as PPP in upper most part discarded by syringe, middle layer is a fibrin gel separated from lower most part RBC[7].

Properties

- Haemostatic
- Wound healing
- Accelerates osteogenesis
- Enhances CT attachment
- Act as scaffolds for cytokines and cell migration
- Promotes epithelial and endothelial regeneration
- Decreases scarring
- Anti-microbial and anti-angiogenic property on non-chronic wound healing.

7 Autologous Fibrin Glue and Sticky Bone:

The concept of mixing autologous fibrin glue with bone graft to obtain sticky bone was introduced by Sohn in the 2010[11].

Preparation

20 to 60 mL of blood obtained in a non-coated centrifuging tube and centrifuged at 2400 to 2700 rpm for 2 minutes. Two layer will be obtained upper layer is fibrin glue extracted using syringe mixed with particulate bone graft and rest it for 10-15 minutes to get polymerized and formation of sticky bone and lower layer RBC is discarded.

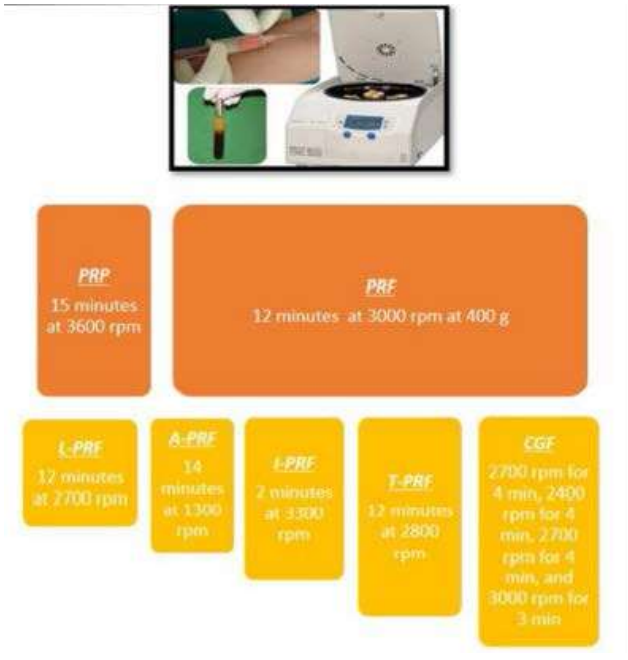

Fig 4: Summary of centrifuging protocol for Platelet concentration preparation

8 Bio-PRF:

Bio-PRF is a 100% natural and autologous three dimensional fibrin scaffolds derived from peripheral blood. Protocols utilized using horizontal centrifugation with bio-PRF system is able to accumulate up to 4 times more platelets and leukocytes when compared to standard fixed angle centrifuges[7].

9 Alb-PRF:

Whole blood collected from peripheral blood in 9-mL plastic tubes was centrifuged at 700 g for 8 minutes. Thereafter, the platelet-poor plasma layer was heated at 75° C for 10 minutes to create denatured albumin (albumin gel). The remaining cells and growth factor found within the buffy coat layer (liquid PRF) were thereafter mixed back together with the cooled albumin gel to form Alb-PRF(Fig 5)[6].

Preparation

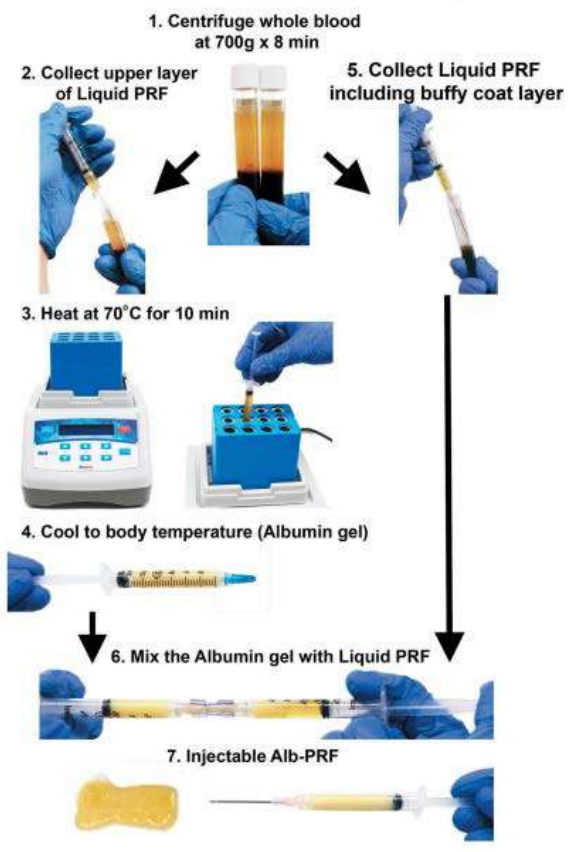

Fig 5: Alb-PRF

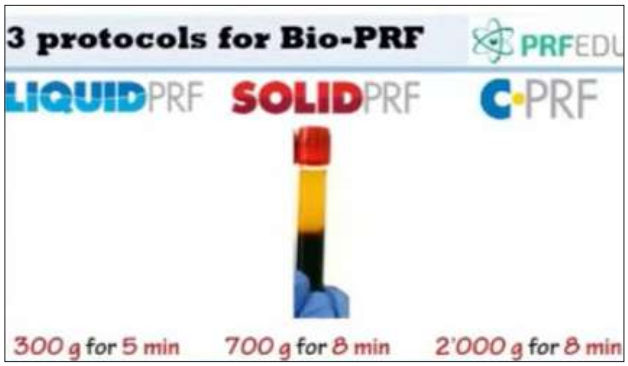

Fig 6: Bio-PRF

Clinical Application

a. Sinus Lift Procedures.

b. Ridge Augmentations.

c. Socket Preservation.

d. Oro-nasal fistula repair.

e. Jaw reconstruction surgeries.

f. Intra Bony Defects.

g. Soft Tissue Procedures[8].

Future Insights

Wang et al, conducted a study recently in a mouse model of lymphoma, doxorubicin loaded platelets enhanced intracellular accumulation of drugs in tumour cells through "tumour cell-induced platelet aggregation". This improved the anti-tumour activity of doxorubicin. The use of advanced delivery systems such as liposomes for encapsulating the platelet concentrates has proved advantageous due to its biocompatibility, low immunogenicity, and protection of growth factors against enzymatic degradation, and long-term bioavailability as well as ease of surface modification for selective targeted delivery. In vitro studies have shown favourable results for enhanced bone regeneration when biodegradable scaffolds such as calcium phosphates and poly lactic-co-glycolic acid were combined with biopolymers such as hyaluronic acid and gelatine for encapsulating PRP[9].

Conclusion

The use of platelet concentrates is a novel approach in the field of periodontal regenerative procedures. This is due to their ability to harbour growth factors that enables enhanced wound healing and accelerated regeneration of periodontal tissues. Being a natural and economical autologous product, it eliminates the risk of adverse reactions and disease transmission. Although various studies based on treatments using platelet concentrates have provided appropriate outcomes, further studies that include large populations are still required to establish its efficacy.

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Covid and Periodontology : A demistifying link

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ABSTRACT

The goal of this review is to find the probable link between periodontal infection and COVID-19. COVID-19 has been declared a global pandemic by the WHO, resulting in a severe shortage of medical resources around the world. There is an economic problem as well as health issues as a result of this pandemic. The similarities in the inflammatory reaction pathway indicates that COVID-19 and periodontitis are likely linked. In the COVID-19 situation, maintaining periodontal health and maintaining dental hygiene should be given top priority. Patients with periodontal disease have a higher chance of developing COVID-related complications.

Keywords: COVID-19; periodontal disease; oral health; general health; public health.

Introduction

Evidence suggests that periodontal disease and systemic illnesses have bi-directional interactions. Periodontitis is a complex, polymicrobial disease that involves both the host and the environment. Tissue damage is most commonly linked to the host's hyper-responsiveness, which results in the production of inflammatory mediators. Bacterial stimulation and tissue death are both aided by pro-inflammatory cytokines.[1] Furthermore, these cytokines are assumed to be at the root of the link between periodontitis and systemic diseases. Increased cytokine production from host cells, often known as the cytokine storm, which has been associated to disease development in COVID-19 patients, according to available research data. A biological link between periodontitis and pulmonary illness exists. Limited studies have found a relationship between COVID-19, cytokines, and periodontal disease.[2] Plaque reduction is required to prevent bacterial transmission from the mouth to the lungs, hence reducing the risk of lung disease. Understanding these connections could help identify high-risk patients and provide needed care at an early stage.

Impact of Periodontal Health on Covid 19

The oral cavity is a major reservoir for pathogens causing respiratory infections and periodontal disease. Microorganisms found in the mouth have been shown to worsen illness in the lungs. Pathogens present in the oral cavity are aspirated into the lower respiratory tract, which occurs more frequently in high-risk patients. Salivary enzymes alter the surface along the mucosa of the respiratory tract, which encourages microorganism colonisation, as well as the release of pro-inflammatory cytokines during periodontitis, which encourages further connection to the epithelium of the lungs and the colonisation of respiratory pathogens.[3]

The risk of colonisation along the oropharyngeal area is reduced when oral health improves, and the

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respiratory system is simplified. The symptoms of the following illnesses have been proven to be reduced by a cleansed oral cavity and a greater awareness of oral health, which is more so in the elderly and patients admitted to ICU, as these individuals are more prone to major complications connected with COVID-19.[4]

The elderly individuals suffering from cardiovascular disease, diabetes, lung illness, or kidney disease, are more likely to worsen the underlying disease as a result of the SARSCoV-2 infection. Improving individuals oral health may improve their general health.Despite the fact that the link between dental health and COVID-19 reality appears to be strong, additional research is needed to fully understand the relationship. Periodontal illnesses have been shown to have a direct impact on human health.[5]

Immuno-Inflammatory Pathogenesis of Covid-19

SARS-CoV-2 infection is characterized by rapid virus replication and aggressive inflammatory responses that can lead to acute respiratory distress syndrome (ARDS) in a few days after the onset of symptoms. A dysfunctional immune response is suspected as the main cause of SARS-CoV-2 infection-induced lung destruction and mortality due to massive infiltration of hyperfunctional neutrophils in these organs. Also neutrophils are recruited constantly to the oral cavity to inorder to combat microorganisms in the dental biofilm and hyperfunctional neutrophil phenotypes causes destruction of periodontal tissues. Elevated host defenses against invading organisms is the major cause thereby causing host damagewhen the immune cells become hyperfunctional. This represents a clear relationship between periodontal disease and COVID.[6]

The viral spike glycoprotein of SARS-CoV-2 binds to the cellular receptor for ACE2 in the host cell.Inside the cell, the virus may "deceive" the immune system by employing strategies that prevent pattern recognition receptors (PRRs) like toll-like receptors (TLRs) from recognising pathogen-associated molecular patterns (PAMPs), and then begin replicating freely within the infected cells using their own organelles and other cellular components.[7]

SARS-CoV-2 binding to ACE2 for cell invasion is the first stage in the cytokine storm, which releases uncontrolled quantities of cytokines such as IL-1, 1L-6, IL-8, and IL-10 (22), priming the host for hyperactive inflammatory responses.The virus-induced infiltration of inflammatory cells into the lungscauses oxidative stress and initial inflammation, also more PMN infiltration into the lung, where cytokines, MMPs, PMN elastase, ROS, and nitric oxide (NO) are released into the inflamed tissue, causing diffuse alveolar damage. These developments describe ARDS as it is found in COVID-19 patients.[8]

PMNs are the first and most abundant innate immune cells to reach the infection site, and so play a critical role in the resolution of inflammation by releasing MMPs, cytokines, ROS, peroxidases. The virucidal effects of ROSenhances vascular and epithelial permeability, allowing PMNs and serosanguinous exudates to continuously infiltrate the alveolar area.

PMN extracellular traps (NETs) helped by activated platelets in response to endothelial injury, ROS and IL-1 generation, and viral replication may raise the risk of thromboembolic events in COVID-19 patients by activating complement and fueling the coagulation cascade further. To avoid this, any treatment that can prevent excessive PMN infiltration and hyperactivation while also blocking excessive MMP activity, elastase activity, and reducing excessive ROS levels or activity while also preventing or ameliorating the morbidity and mortality associated with the cytokine storm/ARDS in COVID-19 patients could be beneficial.[9]

Periodontal disease-induced Immunopathology and Covid-19

Periodontal disease increases microbial and persistent enrolment of PMNs with hyperfunctional or hyperactive phenotypes. These newly hyperactivated PMNs release considerable amounts of ROS and degradative enzymesexpanding levels of proinflammatory cytokines which is seen in COVID-19 patients. These actions cause severe obliteration of the connective tissues surrounding the damaged teeth, resulting in discomfort, bleeding, and tooth loss.[10]

This phenotype of hyperinflammatory PMNs has also been observed to have a role in the etiology of

systemic diseases such as diabetes and cardiovascular disease, suggesting an inter-relationship between periodontal infections and systemic diseases.

This may be due to -

a) The periodontitis-induced inflammatory response or a pre-existing pro-inflammatory state.

b) The host has a genetic propensity to develop hyperinflammatory circumstances, which are conducive to the development of both Periodontal disease and COVID-19.

Dental Periodontal Procedures: Contamination (Splatter, Droplets And Aerosol) in relation to Covid-19

The spread of SARS-CoV-2 infection has an impact on providing periodontal treatment due to high risk of contamination during the procedure. High vacuum suction and Hepa filters and proper fumigation and sterilization protocols have been successful in reducing the contamination to a certain extent.

Conclusion

Current evidence suggests that periodontal health has an indirect impact on COVID 19. Maintaining good oral hygiene may help to lower the risk of developing systemic disorders. However, more research on this topic is required in order to obtain a comprehensive understanding of the relationship between periodontal disease and Covid-19.

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Laser assisted clinical crown lengthening: A case report

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ABSTRACT

Crown lengthening is a surgical technique that lengthens the supragingival tooth structure for restorative or cosmetic reasons. Crown lengthening is a surgical procedure that involves the removal of hard and soft periodontal tissues to acquire supracrestal tooth length, allowing for longer clinical crowns and the restoration of biologic width. Scalpel, electrosurgery, and laser are all options for crown lengthening. But, the use of lasers has many advantages compared to other methods. The advantages of laser over scalpel conventional method include greater precision, a relatively bloodless surgical and postsurgical course, minimal swelling and scarring, cutting, minimal or no suturing and less or no postsurgical pain.

Keywords: Laser, crown lengthening, biologic width

Introduction

Periodontal tissues are the basis for the dentition's proper appearance, function, and comfort.[1] Biological width serves as a shield, preventing microorganisms from penetrating the periodontium.[2] When a tooth is restored without consideration for the biological width, the periodontal response is weak.[3] The sum of the junctional epithelium and supracrestal connective tissue connection is the biological width (Cohen 1962). The average space occupied by the junctional epithelium and supracrestal connective tissue fibers is 2.04 mm, according to Gargiuloet al. (1961), who measured the human dentogingival junction.[4]

Crown lengthening procedure (CLP) is a common technique in clinical practice. By apically displacing the gingival tissue and bone margins, the tooth surface is exposed, making it easier to place restorative margins on the sound tooth surface. The procedure allows a biological width of 2–3 mm to be maintained; ensuring periodontal tissue health.[5-8]

Case Report

A 54-year-old male patient was referred from Department of Prosthodontics with short clinical crown height of upper right lateral incisor to the Department of Periodontology, Annoor Dental College and Hospital, Muvattupuzha. Clinical inspection revealed that the clinical crown was significantly shorter than the anatomic crown. The tooth had undergone root canal treatment two months back and the clinical crown height wasinsufficient for full crown restorationto be placed. Sulcus depth measured using a pocket marker which was more than 2 mm. Patient was apprehensive of the scalpel, so gingivectomy using semiconductor diode laser was used to perform clinical crown lengthening. Scaling and root planing was done prior to the procedure to improve oral hygiene.

Procedure

The operator, patient, and assistant all wore

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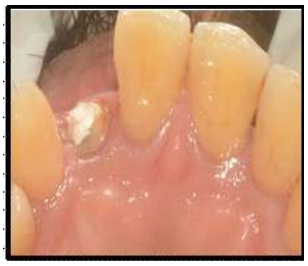
safety goggles. To avoid laser beam reflection, plastic equipment was utilized, as suggested by FDA laser safety standards. Local anesthesia was injected to the surgical field. Bleeding points were marked with pocket marker corresponding to the sulcus depth probed. The diode laser unit was employed in Continuous Wave (CW) mode at

1.5 watts with little brush-like strokes back and forth with deeper progression along the same initial laser incision to remove the tissue, and the tip was kept in constant motion. Using sterile gauze soaked in saline, remnants of the ablated tissues were removed. Patient was given analgesics to use as needed, as well as



Palatal aspect

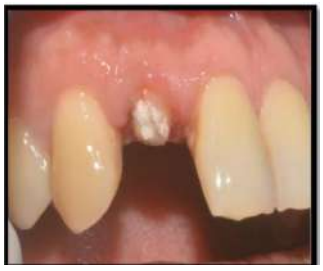


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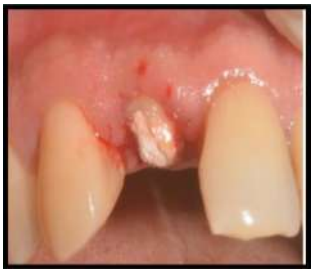
Figure 1: Pre-operative views



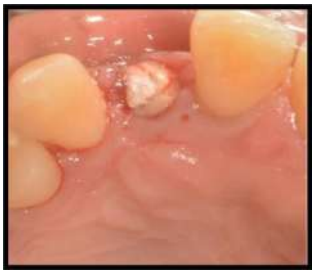


Figure 2: Bleeding points marked corresponding to the sulcus depth with pocket marker

Figure 3: Diode laser unit

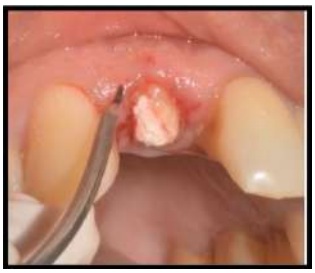
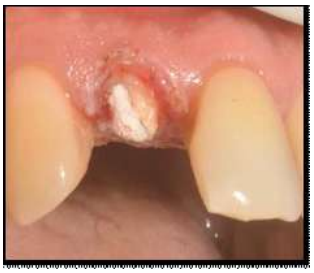
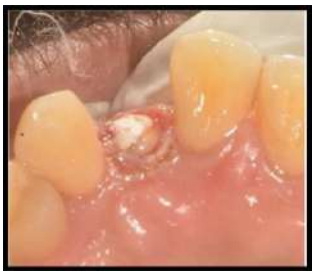


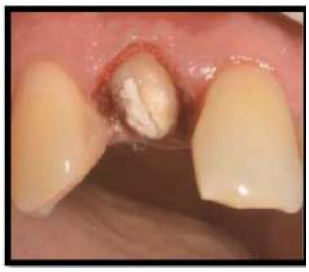
Figure 4: a) Outline of the tissue to be excised marked with the diode laser



b) Outline marked on thebuccalaspect



c) Outline marked on the lingualaspect



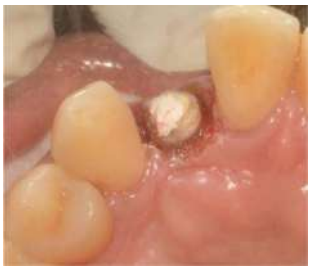


Figure 5: Laser assisted gingivectomy done for crown lengthening

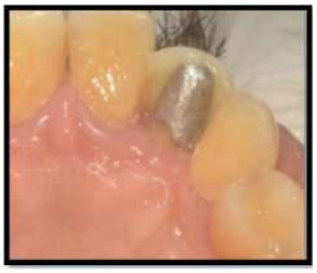


Figure 6: Post and core build up done to increase the prosthetic retention

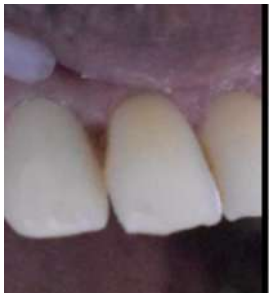


Figure 7: Two months post operative view with the prosthesis

postoperative instructions. Patient did not complain of any pain or discomfort, during procedure or followup.

Discussion

Laser stands for Light Amplification by Stimulated Emission of Radiation. The first working laser was operated by Theodore H. Maiman on May 16, 1960.[9] According to the depth of penetration, lasers can be divided into two types: those that penetrate the tissue deeply (such as Nd: YAG and diode lasers) and those that are absorbed in the superficial layers (such as Er: YAG lasers).[10] A diode laser is a solid-state semiconductor laser that typically combines Gallium (Ga), Arsenide (Ar), and other elements like Aluminum (Al) and Indium (In). Its wavelength is between 810 and 980 nm. Since the diode laser does not interact with dental hard tissues, surgeries can be performed close to them withoutrisk.

Indications of crown lengthening procedure[11]

a) Functional crownlengthening

- To access subgingivalcaries
- To increase the clinical crown height reduced by tooth wear, caries or fracture extending subgingivally
- To correct the position of the restorative margin has been invasion of the biologicwidth

b) Aesthetic crownlengthening

- To correct short clinical crowns due to wear or altered passiveeruption
- To create gingival symmetry in the smileline
- To correct irregular/uneven gingivalmargins
- To correct for hyperplasic tissueovergrowth

Contraindications[12]

- Inadequate crown-to-rootratio
- Non-restorability of caries or rootfracture
- Estheticcompromise
- Highfurcation
- Tooth arch relationshipinadequacy

Greater precision, a generally bloodless surgical and postsurgical course, sterilization of the surgical area, minimal swelling and scarring, coagulation, vaporization, cutting, minimal or no suturing and less or no postsurgical pain are all advantages of laser technique over scalpel surgical procedure.

Conclusion

The use of laser has several benefits over the scalpel surgery. The use of a diode laser in crown lengthening was found to be a safe and effective procedure. Patient satisfaction was high following surgery. There was no infection, pain, swelling, or scarring during the gingival healing process.

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JSPIK

Moving with your biological rhythm: A review on Melatonin and Periodontitis

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ABSTRACT

The objective of this review is to uncover the potential of melatonin as a therapeutic agent in periodontal diseases. Melatonin has shown to exert its therapeutic effects in terms of its anti-inflammatory, antioxidative, antimicrobial and osteogenic potential. The role of melatonin as an immunomodulatory agent is essential for it to be indicated as a treatment modality.

Keywords: Melatonin, circadian rhythm, biological rhythm, biological clock, periodontium, oral health, chronobiology, chrono dentistry.

Introduction

We all can relate to being exhausted to such extents as to falling asleep on the couch or while watching television. However, what we don't realise is that physical fatigue is not the only reason that causes us to slip into dreamland. Our entire existence is being controlled, not only by fate but by chemicals. Chemicals being hormones secreted in our body.

The human body is able to comprehend the day and night rhythm and knows when to fall asleep. This entire 24-hour governing cycle is what we call the "The Circadian Rhythm".[1] There are a lot of rhythms that the human body comprehends as routines. These include the diurnal rhythm which is the circadian rhythm synchronised with day and night cycles. The ultradian rhythm which is of a shorter period and higher frequency and Infradian rhythm which lasts for more than 24 hours, such as the menstrual cycle. The virtual synchrony of these rhythms is what constitutes our 'Biological Clock' or the suprachiasmatic nucleus present in the hypothalamus.[2]

Melatonin is the chemical secreted principally by the pineal gland that is involved with the circadian rhythm. It can be called as the sleep hormone as it is elevated during the night and while sleeping. A lot of mechanisms are interlinked with sleep. The most surprising of it is that sleep is associated with oral health as well. Along with other aspects of oral health, melatonin is also linked with the structural integrity of the periodontium. Periodontal disease is often an interplay of microbial interaction, host response and a vast array of environmental and lifestyle factors. The evidence of melatonin and its effects in the periodontal tissues suggests a possible role of melatonin and circadian rhythm in periodontal tissues.

Melatonin Synthesis

Pinealocytes present in the pineal gland are mainly synthesize melanin using the amino acid Tryptophan. (Figure 1)

Two enzymes found in the pineal gland are involved in melatonin synthesis: acetylserotonin-O-methyltransferase (ASMT, also called hydroxyindole-

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O-methyltransferase or HIOMT) and AA-NAT, also called "Timezyme", is the rate-limiting enzyme for melatonin synthesis. Both AA-NAT and ASMT activities are controlled by noradrenergic and neuropeptidergic projections to the pineal gland.[3] This hints at a sympathetic nervous system involvement.

What is the biological clock?

The biological clock can be visualised as a virtual clock which consists of a network of its own. This includes a central and peripheral network.

The input pathway senses external timing signals that are called entrainment factors, for example, light/dark, and sends information to the core circadian clock. The core circadian clock forms endogenous CR according to external time cues to allow for adaptation to the environment. Based on changes in the core circadian clock, the output pathway adjusts the physiological activities in various tissues and organs through neurohumoral regulation.

Entrainment factors

The circadian cycle in all mammals is regulated by certain external factors. these are called "entrainment factors", "synchronizers," "zeitgeber," that can reset the body's circadian clock by a process called circadian rhythm synchronization. Some of which are light, arousal stimuli including non-photic entrainments which include social interactions, exercise, restraint stress, and caffeine-induced arousal. Food, temperature and chemical stimuli like glucocorticoids can also serve as entrainment factors.[4]

Sources of melatonin

The distribution of melatonin varies significantly across body fluids.Apart from the pineal gland, the human body has a lot of additional sources of melatonin production. These include the retina,ovary, lens, GI tract and immune cells.[5] The lipophilic nature of melatonin allows it to enter every cell and is found in high concentrations in different cellular organelles.

Normal plasma melatonin levels range between 14 to 60 pg/ml. Melatonin has its highest levels in plasma during night, peaking between 12:00 am and 2:00 am and also between 2:00 am and 4:00 am, and is lowest during the day (between 12:00 pm and 2:00 pm).[6]

Melatonin has been detected in saliva and Gingival Crevicular Fluid (GCF). Both arylalkylamine N-acetyltransferase and hydroxyindole-Omethyltransferase (currently known as acetylserotonin methyltransferase) were shown to be expressed in the striated ducts and epithelial cells of these glands. These enzymes convert serotonin to melatonin.[7] It has also been demonstrated in gingival tissue samples of both healthy and periodontitis patients.[8]

Role of Melatonin in Periodontitis

Melatonin has been long known for its anti-inflammatory, antioxidant and immunomodulatory actions. In addition to this, it also plays an important role in bone metabolism. Melatonin has also been researched as a potential biomarker as well. In this section, melatonin will be described under the following headings:

1. Anti-oxidant effects
2. Anti-inflammatory and Immunomodulatory effects
3. Anti-microbial action
4. Bone osteogenic activity
5. Biomarker
6. Role in implant dentistry

Antioxidant effects

Melatonin exerts its antioxidant effects by both direct and indirect methods. It directly neutralizes a number of toxic oxygen- and nitrogen-based reactants, including the hydroxyl radical (OH), hydrogen peroxide (H_2O_2), hypochlorous acid (HOCl), singlet oxygen (1 O_2), the peroxynitrite anion (ONOO) and peroxynitrous acid (OHOOH). Melatonin also has indirect antioxidative actions, stimulating the synthesis of another important intracellular antioxidant, glutathione (GSH), and promoting its enzymatic recycling in cells to ensure it remains primarily in glutathione reduced form. Finally, MLT preserves the functional integrity of other antioxidative enzymes, including superoxide dismutases and catalase. MLT may also reduce free radical generation in mitochondria by improving oxidative phosphorylation, thereby lowering electron leakage and increasing ATP generation.[9]

Anti-inflammatory and immunomodulatory effects

It demonstrates pro-inflammatory and immunostimulatory effects by increasing neutrophil recruitment into inflammatory sites and also increases chemotaxis and neutrophilic phagocytosis. Melatonin is a potent inhibitor of NF kappa B transcription, thereby reducing the production of IL-1 beta and TNF alpha. Melatonin has been regarded as an anti-TNF alpha compound and has been found to enhance antigen presentation by macrophages to T lymphocytes that enhances the natural killer cell activity.[10]

Innate immune cells such as macrophages and neutrophils exhibit strong circadian oscillations in the core clock and clock-controlled genes, leading to rhythmicity in their physiological functions. Furthermore, toll-like receptors of tissue-resident macrophages are also rhythmic. These evidences indicate the possibility that circadian disruption may impair the first defence mechanism in the periodontal front.

A relationship between interleukin (IL)-2 and melatonin neuro-immunomodulatory function also has been documented, with melatonin promoting the endogenic production of IL-2. The increase in IL-2 levels in the blood at night may be a result, at least in part, of the concomitant increase in blood melatonin concentrations. Melatonin activates CD4+ lymphocytes by increasing the production of IL-2 and interferon-gamma. This suggests that melatonin may be involved in the regulation of immune functions by modulating the activity of CD4+ cells and monocytes.[12]

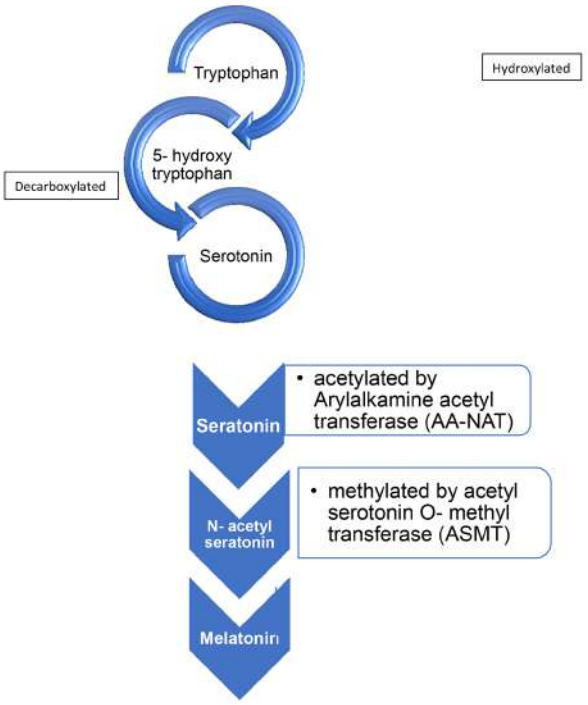

Figure 1: Schematic representation of synthesis of Melatonin

Antimicrobial action

Melatonin possesses antimicrobial properties against a variety of bacteria and viruses. However, to the authors' best knowledge, no studies have been conducted testing the effects of melatonin against cariogenic bacteria such as Staphylococcus mutans and Lactobacillus. Nevertheless, in 1976, a study by Mechin and Toury reported significantly reduced caries in rats receiving intraperitoneal injections of melatonin compared with those receiving no melatonin injections. The direct antimicrobial action of melatonin, synergistically supported by its immunomodulatory and antioxidant properties may prove to be a potent weapon against numerous oral infections.[13]

Bone osteogenic activity

Melatonin's osteoblast-enhancing function is thought to contribute, in part, to its positive effects on bone.Melatonin increases bone alkaline phosphatase levels and mineralization, promotes the synthesis of collagen type I, a major determinant of bone strength, and increases bone mass. In addition to increasing bone mass, melatonin also facilitates new bone growth. Sustained release of melatonin by the use of poly-lactic-co-glycolic acid microspheres, another delivery system for melatonin, has also been shown to differentiate human mesenchymal stem cells (hMSCs) into osteoblasts.

Even though the data are limited, a role for melatonin in regulating osteoclast activity is emerging. For example, decreases in melatonin are associated with increases in bone resorption, suggesting that melatonin may be acting as an endogenous osteoclast inhibitor. Figure 2 shows the schematic representation of the relationship between melatonin secretion and bone resorption over a 24-hour cycle.In another study,

melatonin-mediated inhibition of bone resorption was accompanied by decreases in RANKL-mediated osteoclastogenesis. Melatonin's ability to inhibit RANKL-mediated osteoclastogenesis is thought to occur through melatonin's action on osteoblasts to induce osteoprotegerin levels.[14]

Biomarker

Varying melatonin levels in saliva when detected could pave way for diagnosis, proving its role as a biomarker. Melatonin is observed to cause a reduction in salivary levels of CRP (serum C-reactive protein) and TNF-alpha. Topical formulation of melatonin has shown to cause a reduction in GCF levels of IL-1 beta, IL-6, and PGE2 along with a reduction in salivary TNF alpha levels and an overall improvement in insomnia.[10]

Role in implant Dentistry

Melatonin has been shown to promote osseointegration and to have beneficial effects on bone repair. It has relevant clinical importance because it could be used as a therapeutic agent in situations in which it is necessary to increase bone formation, such as in the creation of a bioactive surface on dental implants.

Dental implants surrounded by melatonin increase histomorphometric parameters, including Bone to Implant contact (BIC) area and inter-thread bone at 2 and 8 weeks. Melatonin acts on the bone as a local growth factor, with paracrine effects on nearby cells. The rise in BIC signifies the direct action of melatonin on osteoblasts, which induces a higher rate of maturation of preosteoblasts to osteoblasts both in quantity and velocity, with a higher rate of production of the osseous matrix and its corresponding calcification. Moreover, other studies show that melatonin could favor bone formation by other routes, as in the stimulation of certain genes that control the presence of determined proteins in the osteoid matrix.[15]

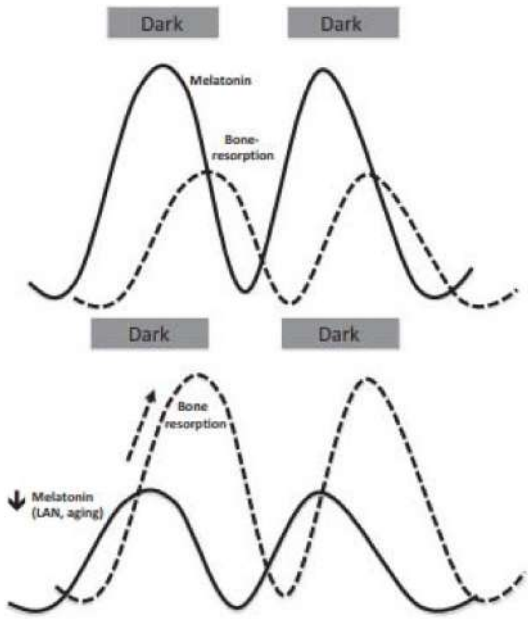

Figure 2: Depicted is a schematic demonstrating the relationship between melatonin secretion and bone resorption over a 24-hr cycle. As shown, both bone resorption (dotted line) and melatonin (solid line) display a diurnal rhythm with peaks occurring during the hours of darkness (filled in rectangles). A suppression of nocturnal melatonin levels, either through light exposure at night (LAN) or through aging, increases bone resorption. Restoring nocturnal melatonin peaks over time may protect against bone loss by suppressing bone resorption.

Linking Melatonin And Systemic Health[16-19]

Diabetes Mellitus

Apart from the well-established functions of MEL as an antioxidant and anti-inflammatory agent, this indolamine exerts an important role in glucose metabolism. It has been described that the synthesis of the pineal MEL and the pancreatic insulin depends on one another. It has been confirmed that the treatment with MEL decreases insulin secretion.The synthesis and secretion of both hormones are linked by a circadian manner.

Cardiac Diseases

Mounting evidence has revealed that the blood melatonin rhythm has a crucial role in several cardiovascular functions, including daily variations in blood pressure and pathophysiological processes including anti-inflammatory, antioxidant, anti-hypertensive and possibly anti-lipidemic functions. Patients with coronary artery disease have been reported to have low melatonin production rates, and blood melatonin concentrations correlate with the severity of the disease. Melatonin also has a role to play in preventing damage due to ischemia/reperfusion

(I/R) injury in cardiac disease patients. People with high levels of low-density lipoprotein cholesterol typically have low levels of melatonin. It has been shown that melatonin suppresses the formation ofcholesterol by 38% and reduces low-density lipoprotein accumulation by 42% in freshly isolated human mononuclear leukocytes. Several in vitro studies have documented the antioxidant actions of melatonin on lowdensity lipoprotein oxidation.

Rheumatoid Arthritis

Circadian rhythm is known to influence the pathophysiology of, and clinical symptoms in, rheumatoid arthritis (RA).The basal melatonin concentrations are higher, and the nocturnal rhythm shows peak levels earlier, higher and of longer duration, in patients with RA in comparison with healthy individuals. Accordingly, cytokines secreted by type 1 T helper (TH1) cells—IFN-γ, IL-1, IL-2, IL-6, IL-12, and TNF—reach peak production during the late night and early morning, when melatonin serum levels are highest and plasma cortisol is lowest, especially in patients with RA.

Psychiatric Disorders

Concerning psychiatric disorders, secretion disturbances of the pineal gland have been described in child and adult psychiatry, with notably in most studies a decreased nocturnal melatonin secretion observed in major depressive disorder, bipolar disorder, schizophrenia or autism spectrum disorder.

Its neuroprotective activity in animal models of ischemic stroke, as well as its lack of serious toxicity suggests that melatonin could be used for human stroke treatment in the future.There is increased experimental evidence showing the therapeutic potential of melatonin in neurodegenerative conditions such as Alzheimer disease, Parkinson disease, Huntington's disease and amyotrophic lateral sclerosis.

Pregnancy

Maternal melatonin crosses the placenta freely and enters the fetal circulation with ease providing photoperiodic information to the fetus. Melatonin works in a variety of ways as a circadian rhythm modulator, endocrine modulator, immunomodulator, direct free radical scavenger and indirect antioxidant and cytoprotective agent in human pregnancy and it appears to be essential for successful pregnancy.

Cancer Therapy

Melatonin plays a preventative or therapeutic role against oral cancer due to its antioxidant properties. Additionally, melatonin prevents damage to healthy tissues due to radiotherapy, which is routinely employed to treat oral cancers. A recent in vitro study suggests that melatonin may impede metastasis of oral cancer by inhibiting metalloproteinase-9 activation.

Sleep And Periodontal Disease

There is a close association between circadian rhythms, sleep and metabolism. Any disruption of circadian rhythm leads to metabolic perturbations including periodontal disorders. Infact, the metabolic syndrome is found to be more prevalent in shift workers, known to exhibit disturbances of the circadian rhythm.

From the periodontal aspect, cellular components of periodontal pathology, including fibroblasts, bone cells, and immune cells, are related to the circadian clock. Human SMAD3 in gingival fibroblasts is regulated by major clock genes CLOCK/BMAL1. Glucocorticoids, a major hormone dominated by the circadian clock. Innate immune cells such as macrophages and neutrophils exhibit strong circadian oscillations in the core clock and clock-controlled genes, leading to rhythmicity in their physiological functions. Furthermore, toll-like receptors of tissue-resident macrophages are also rhythmic. These evidences indicate the possibility that circadian disruption may impair the first defence mechanism in the periodontal front.[20] Stage-grade of periodontitis is known to be associated with short sleep duration, low sleep quality and low oral health related quality of life.[20]

Commercial Availability of Melatonin

Immediate-release melatonin is not tightly regulated in countries where it is available as an over-the-counter medication. It is available in doses from 0.3 mg to 10 mg or more, it is possible to buy raw melatonin powder by the pound. Immediate-release formulations cause blood levels of melatonin to reach their peak in about an hour. The hormone may be administered orally, as capsules, gummies, tablets,

or liquids. It is also available for use sublingually, or as transdermal patches.[20] Topical application of Melatonin as creams and gels are also available.

Conclusion

There is a number of mechanisms that are co-ordinated with one another to provide a stable milieu interior. Disruption of daily activities like sleep, although though to be menial could result in disruption of this balance. The role of melatonin with its therapeutic benefits pave way for future developments in the field of Medicine and Dentistry.

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Nutraceuticals in Diabetes Mellitus and Periodontitis: A Review

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ABSTRACT

Diabetes mellitus is a complex metabolic disorder characterized by chronic hyperglycemia with a proven impact on periodontal health. Diabetic patients with poor metabolic control exhibits higher prevalence and severity of periodontitis. According to DeFelice, Nutraceuticals can be defined as, "food (or part of food) that provokes medical or health benefits including prevention and treatment of diseases. Several nutraceuticals used in clinical practice have been shown to target the pathogenesis of diabetes and also demonstrate a favourable effect on the periodontium by modulating the host immune inflammatory response and inhibiting pathogenic bacteria and bacterial toxins. Since these agents play a significant role both in diabetes and periodontitis, it can be used as adjunct to periodontal therapy in patients with diabetes. This review highlights various nutraceuticals agents and their beneficial adjunctive role in diabetic mellitus and periodontitis.

Keywords: periodontitis, nutraceuticals, free radicals, diabetes mellitus.

Introduction

Periodontal disease is an inflammatory disease affecting the supporting structures of the periodontium. The host bacteria interaction as the biofilm insult leads to liberation of bacterial toxins and chemical mediators that provokes inflammatory response in the host. The exaggerated inflammatory response in the host ultimately leads to the alveolar bone loss. The elimination/suppression of the periodontal pathogens is needed for the optimal repair and healing of the periodontium.[1] The term "Nutraceuticals" is derived from"Nutrition" and "Pharmaceuticals". It was coined by Dr. Stephen deFelice in 1989. Nutraceuticals is defined as food or part of a food that provides medical or health benefits. It refers to bioactive compounds, which can provide health-promoting effects. Odonto-nutraceuticals play significant role in controlling the complex and multifactorial diseases like periodontitis. Nutraceuticalsare used to target the pathogenesis of diabetes mellitus and to favourably modulate a number of biochemical and clinical endpoints.[2] It is also the most promising agents in Periodontics due to their ability to control various molecular and biochemical process. The therapeutic effects obtained with treatment of combined neutraceutical compounds are more effective than individual compounds due to its synergistic/additive properties. Nutraceuticals containvitamins, lipids, proteins, carbohydrates andminerals which are responsible for maintaining periodontal health and prevention of periodontal disease progression. Dietary supplements are intended to supplement the diet by increasing the total dietary intake. Dietary supplements are not intended to treat/cure the disease, whereas nutraceuticals more emphasize on prevention or treatment of periodontal

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diseases.[2, 3]

History of Nutraceuticals

Hippocrates (460–377 BC), the father of modern medicine laid the foundation for nutraceuticals through "Let food be thy medicine and medicine be thy food". Roman Physician Galen designed and formulated the diet regimen which would maintain the health standards of the entire population. Francois Magendie found that food devoid of nitrogen provides nutrition whichinitiated thenutrition research in 19th century. This modulated the scientific mind to think beyond carbohydrates, proteins and fats to achieve proper nutrition. On many clinical situations, dietary alterations became the remedy for disease instead of medicines. With the passage of time due to the development of scientific knowledge, food habits were modulated for prevention/treatment of disease which produced the modern day concept of nutraceuticals.[4]

Classification of Nutraceuticals

Nutraceuticals can be classified on the basis of their sources into following types:[5, 6]

a) Traditional/natural nutraceuticals

1) Based on chemical Constituents:

- ❖ Nutrients
- ❖ Herbals
- ❖ Phytochemicals

2) Nutraceuticals enzymes

3) Probiotic microorganisms

b) Non-traditional/unnatural nutraceuticals

1) Fortified nutraceuticals

2) Recombinant nutraceuticals

Health Benefits of Nutraceuticals

- ❖ Easily available
- ❖ Economically affordable
- ❖ No adverse effects
- ❖ Increase the health benefit
- ❖ They are natural dietary supplement, so they do not have any unpleasant effect.
- ❖ They increase the health value thereby improves medical condition

Nutritional therapy is a healing system using dietarytherapeutics or nutraceuticals as a complementary therapy. This therapy is based on the concept that foods can not only be sources of nutrients and energy but also provides medicinal benefits. According to the theory of nutritional therapy,nutraceuticalshelps to detoxify, avoid vitamin and mineral deficiencies, restoring healthy digestion and dietary habit. Dietary supplements are not intended to treat or cure disease, whereas nutraceuticalsare utilised for the treatment or prevention of diseases.[6]

Role of Vitamins (Nutraceuticals) in Periodontitis and Diabetes Mellitus

Vitamin A: Vitamin A helps to maintain periodontal health and prevents disease progression. The vitamin A is also important for maintaining certain bacteria at adequate levels and prevents over-inflammation.[7, 8]

Vitamin B complex: Vitamin B complex refers to essential water-soluble vitamins except Vitamin C. Vitamin B complex includes thiamine (Vitamin B1), riboflavin (Vitamin B2), niacin (Vitamin B3), pantothenic acid (Vitamin B5), pyridoxine (Vitamin B6), biotin (Vitamin B7), folic acid (Vitamin B9) and cobalamin (Vitamin B12). Vitamin B complex has been found to prevent gingival inflammation. Many studies revealed that vitamin B complex do not to have any role in periodontal disease.[7, 8]

Vitamin C/Ascorbic acid: Vitamin C is a chain-breaking antioxidant, scavenging reactive oxygen species directly and preventing the propagation of chain reactions.It is a powerful antioxidant in living organisms at intracellular level. It reduces diabetes-induced sorbitol accumulation and lipid peroxides formation in erythrocytes in in-vitro studies. 800 mg/day of Vitamin C partially replenishes vitamin C levels in patients with type 2 diabetes mellitus. The low vitamin C level does not improve insulin resistance. Vitamin C stabilizes the collagen structure by hydroxylation. It maintains the integrity of connective tissues such as alveolar bone, periodontal ligament and cementum. Vitamin C improves the immune system and accelerates the wound healing. Vitamin C decreases RANKL expression and osteoclastogenesis stimulation when supplemented with diet.[7, 8]

Vitamin D: The active form of Vitamin D

is 1, 25-dihydroxycholecalciferol. It helps in bone remodelling and plays an important role in alteringthe immune system by suppressing inflammation and by inhibitinginflammatory cells. Vitamin D plays a role by improving the health of periodontaltissues. The good calcium/Vitamin D status helps to preserve insulin sensitivity and thereby prevent diabetes mellitus.No prospective studies have examined the association of habitual vitamin D intake for diabetes risk.[7, 8]

Vitamin E: Vitamin E is an essential fat soluble vitamin and functions primarily as an antioxidant. It stops the production of reactive oxygen species by terminating the free radical chain reaction. Low levels of vitamin E is associated with increased incidence of diabetes mellitus. The diabetes mellitus patientsmay have greater anti-oxidant requirements, due to increased free radical production secondary to hyperglycaemia. Doses of vitamin E up to 400 IU are generally considered to be safe. Doses over 800 IU may alter blood clotting. Vitamin E has protective effect on the periodontal health by increasing the nitric oxide synthatase level and prevents the oxidative stress.7,9

α- Lipoic acid: α-Lipoic acid is a naturally occurring potent antioxidant. It has unique property of scavenging reactive oxygen species in its oxidized state and quenching several radicals. α- lipoic acid and dihydrolipoic acid works in redox couple and have properties like chelation of transition metals and regeneration of other antioxidants such as glutathione, Vitamin C and Vitamin E. α- Lipoic acid protects the retina against ischemia-reperfusion injuries in diabetic retinopathy. α-lipoic acid increases insulin sensitivity 18–20% in periodontitis patients with type 2 diabetes mellitus.[7, 10]

L-Carnitine: L-carnitine is a natural vitamin like compound. It is supplied through dietary sources and by biosynthesis from lysine and methionine. L-carnitine supplementation promotes insulin sensitivity and has lipid-lowering actions. It performs a number of essential intracellular and metabolic functions such as fatty acid transport across the inner mitochondrial membrane for β-oxidation, detoxification of toxic metabolites, regulation of mitochondrial acyl-Co A/CoA ratio and stabilization of cell membranes. L-carnitine supplementation has beneficial effect inperiodontitis patients with insulin resistance.[8, 10]

Types of Nutraceuticals used in Periodontitis and Diabetes Mellitus Patients

Chromium: Chromium is a trace element that has effect on both general and dental health. The chromium supplements may increase insulin sensitivity and improve glucose tolerance in patients with type 2 diabetes mellitus. A meta-analysis of RCTs investigating the effects of chromium supplementation on glucose and insulin response in healthy individuals and diabetes showed significant improvement in glycemic control in the healthy individuals, but not in the diabetes mellitus. Hence, American Diabetes Association suggested that inconclusive evidence for the benefit of chromium supplementation in diabetes mellitus.[9]

Magnesium: Magnesium-rich diet decreases the risk for diabetes mellitus. The inverse correlation exists between the magnesium intake and fasting insulin levels. Magnesium helps to preserve adipocyte insulin sensitivity. Magnesium has positive correlation with periodontal disease suppression.[9, 11]

Vanadium: Vanadium transports glucose into the cells similar to the insulin. Vanadium supplementation decreases the fasting blood glucose levels, HbA1c levels and cholesterol levels. Vanadium with dose of 45-150 mg/day is useful in improving fasting glucose levels. Clinical trials showed that these dosage levels are safe and well tolerated by the patients without major adverse events.[10]

Iron: Iron is the most abundant and essential trace element in the human body. Optimal levels of iron are vital for periodontal health and shift in either direction may be detrimental. The PDL cells have the ability to regulate iron uptake by expressing the light and heavy chains subunits of heteromeric ferritin. This controls the cyto-differentiation of cells into osteoblasts and mineralisation thereby affecting the bone density. Iron is also important for both innate and adaptive immune responses. Its deficiency weakens the cell-mediated immunity by reducing lymphocyte count, interferon-γ and interleukin-2 levels and functions of natural killer cells. Iron has an important role in oxidative burst. A shift in the iron levels may cause oxidative stress leading to periodontal destruction.[10]

Selenium: Selenium is an antioxidant mineral. Its biological functions are mainly exerted through

selenoproteins, which are a group of antioxidants involved in activation, proliferation and differentiation of innate and adaptive immunity cells. They prevent the exacerbation of immune responses in chronic inflammation. It is present in the glutathione peroxidase system and helps to minimize oxidative damage to lipid membranes. The glutathione peroxidase enzymes utilize selenium at their active sites to detoxify reactive oxygen species. The beneficial effects of selenium on periodontium are mainly due to its antioxidant effects. The level of glutathione, catalase and selenium is significantly lower in periodontitis patients with type 2 diabetes mellitus.[11]

Role of Nutraceuticals in Periodontal Therapy In Diabetic Patients

1. Nutraceutical Basis for Drug Delivery in Periodontitis

Local drug delivery is defined as sustained, prolonged, self controlled release at the defect site.

Advantages of nutraceuticals based drug delivery[12,13]

- ❖ Reduction in total drug usage when compared with systemic therapy.
- ❖ Super infection and drug resistance are rare.
- ❖ Minimal side effects
- ❖ Improved patient compliance

Disadvantages of nutraceuticals based drug delivery [12,13]

- ❖ Drugs may not reach the deep areas of pocket.
- ❖ Time consuming
- ❖ Require special efforts

Nutraceuticals baseddrug delivery carrier / vehicle in periodontitis

Fibres: Fibres act as reservoir ofdrug. These fibres containsactive drug which released for a prolonged duration when kept in the affected area. Fibres are secured with cynoacrylates in affected area.[14, 15]

Films: Films are made up of polylactide-co-glycolide. They are inserted into the periodontal pocket. They showed excellent reduction in the probing depth when used clinically.[14,15]

Injectable systems: Injectable systems are comparatively easy method of delivering the antimicrobial agents in the periodontal pockets. The drug is delivered at the site without pain and reaches the base of the pocket thus getting better access to the subgingival microflora.[15]

Microspheres: Microspheres are made up of synthetic polymer or natural polymers. Natural polymers include albumin, gelatine, agarose and chitosan while synthetic polymers include glycolides, poly alkyl cyanoacrylates and poly anhydrides. The

Table 1: Some commercially marketed nutraceuticals[13]

Product	Category	Composition
Calcirol D-3	Calcium supplement	Calcium and Vitamins
WelLife	Amino acid supplement	Granulated-L-glutamine
Proteinex	Protein supplement	Predigested proteins, Vitamins
CogniSure	Amino acid supplement	Proline-rich polypeptide complex
Omega woman	Immunesupplement	Antioxidants, Vitamins and Phytochemicals
GRD	Nutritional supplement	Proteins, Vitamins, Minerals and Carbohydrates
WeightsmartTM	Nutritional supplement	Vitamins and trace elements

active drug in the microspheres is released slowly. Rate of degradation of microspheres determines the rate of drug release. Depending on the rate of degradation they are classified into surfaceeroding and bulk eroding. The bulk eroding microspheres will allow the permeation of water intothe matrix and whole microsphere is degraded. On the other hand, surface eroding microspheres don't allow the water to permeate through the sphere and thus allowing slow degradation of the matrix.[15,16]

Gels: Gels comprise of carbopo l 974, hydroxyethyl cellulose and polycarbophil. The gel is carried in the pocket with a blunt syringe. It doesn't dissolve water and the drug delivery occurs at a faster rate.[15,16]

Strips and Compacts: The strips are made from mixing polymers, monomers and different agents. They are flexible enough for placing in the periodontal pockets.[16,17]

Vesicular system: Liposome systems are covered by a membranous lipid bilayer, and mainly composed of natural and synthetic phospholipid. They are nontoxic and biodegradable. The drug is protected from immediate dilution or degradation.[17,18]

Nanoparticle system: Nanoparticle system consists of nanoparticles, polymeric micelles, nanocapsules, nanogels, metal nanoparticles and quantum dots. The main advantages of nanoparticle systems are high dispersibilty, controlled release rate, increased stability and easily reach the base of pocket. Oligonucleotide loaded chitosan nanoparticles found to be stable in the oral cavity for 12 hours.[15,19]

2. Nutraceuticals in Dentin Hypersensitivity

Desensitizing dentifrices containing 15% Hydroxyapatite nanoparticles, fluoride and Nutraceuticals like Curcuma longa reduced of dentin hypersensitivity clinically.[16]

3. Nutraceuticals in Periodontal Regeneration

The most commonly used are Nano–HAP composite bone graft which are available in crystalline and titanium reinforced forms. These Nano-HAP composite bone graft scaffolds are biocompatible with superior mechanical properties. The nanoceramic composite materialsused in periodontal regeneration comprises of nutraceuticals namely,

- ❖ Nanocrystals of CaSO4 with particle size ranging from 200-900 nm; improve resistance to degradation, last longer (12- 14 weeks) than conventional CaSO4.
- ❖ CaPO4 + ZnO (antibacterial)
- ❖ Carbon nanotubes provides flexible and inert scaffold on which the cell proliferate and deposit new bone.[17]

Increased Demand for Nutraceuticals

Modern day work profile results in the development of various life–style disorders. The common cause for these disorders is improper diet, lack of physical inactivity, non-alignment with biological clock and excessive stress. Nutraceuticalsis a blend of modern science and natural agents and it can be a possible solution for management of life style disorders. Nutraceuticals can help to block the transformation of life style disorders into fatal diseases. [18]

Future Challenges

Though the science of nutraceuticals appears to be not feasible in the present scenario, the future holds strong promise for the delivery of nutraceuticals for the prevention of periodontal disease. The challenge will be to fabricate the devices which will easily deliver the nutraceuticals in the periodontal pockets and will help in prevention of periodontal disease. The delivery of nutraceuticals with newer technology will definitely benefit the patients and the practicing dentists. More studies are necessary to test the efficacy of these devices in prevention and control of periodontal disease in patients.

Conclusion

The complex relationship exists between the nutritional status of the host and periodontal disease. Based on the evidence, nutrients can be used as an adjunctive to the periodontal treatment. Nutraceuticals have proven health benefits and their consumption helps to maintain health and prevention of the disease. It is a powerful instrument in maintaining healthand to act against nutritionally induced acute or chronicdiseases, thereby promoting optimal

health, longevity, andquality of life.Nutraceuticals have a very limited value if the chronic inflammatory stimulus from dental plaque/biofilm is not removed. Nutraceuticals in clinical practice is still in the emerging phase, the pharmaceutical and clinical issues need to be addressed by further well designed clinical trials.

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