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HEMOLASER – An ingenious procedure to reconstruct interdental papilla: A case report

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ABSTRACT
This case report portray a contemporary method for reconstructing interdental papilla using low level laser. This simplified time saving approach is an alternative to noninvasive and other conventional surgical techniques. **Case presentation**: A 32-year-old female patient presented on July 2022 at the department of periodonticswith the chief complaint of spacing between the upper front teeth causing a compromise in the aesthetics since 2 years.Clinical and radiographic examination revealed that the patient had class 1 papilla (Norland and Tarnow classification 1998).[12] The interdental bone was within 5 mm from the contact point. **Result:** Hemolaser therapy was advocated for reconstructing the lost interdental papillabetween 11 and 21. Partial coverage was obtained after 3 weeks and complete coverage was documented after a follow up period of 6 weeks. **Conclusions**:Interdental papilla reconstruction using hemolaser therapy is a new horizon to minimally invasive techniques withminimal discomfort and quick recovery.

Key words: Interdental papilla, Laser, Reconstruction, Black triangle

I. INTRODUCTION

Aesthetic awareness has improved vastly in the last decade. In aesthetically important zones, achieving "white" and "pink" aesthetics is the ultimategoal of contemporary restorative dentistry. In dentistry, deficient interdental papilla which comprise interdental papilla, forms what in odontology is called the black triangles.[1]In today's scenario, obtaining a predictable interdental papilla in the aesthetic zone is one of the trickiest parts of periodontal reconstructive surgery.One of the most unesthetic and phonetic predicament is the absence of interdental papilla but also a functional detriment as it predisposes to food accumulation.[1]

In anterior region, shape of the interdental papilla is pyramidal and posteriorly its col shaped. It is very much rigorous to reconstruct the interdental papilla. The presence or absence of interdental papilla is related to the inference of the following factors:tooth loss, poor oral hygiene practises, interproximal contact position, ageing, periodontal disease, loss of alveolar bone height in relation to the interproximal contact, length of the embrasure area, roots diverging, and triangular-shaped crowns.[2]

Various non-invasive and invasive techniques have been used to augment/reconstruct the interdental papilla, to reclaim the pink triangle. By augmenting or reconstructing the lost papilla, the most pleasing and natural appearance can be achieved because pink aesthetics are just as significant as white aesthetics. A number of surgical techniques have been developed by various authors such as Beagle,[3]Azzi et al,[4] Han and Takei,[5] Carnio,[6] and Froum et al.[7] in an attempt to convert the black triangle into an aesthetic pink triangle.

Surgical reconstruction of interdental papilla is an option, although it frequently presents a challenge to the surgeon dentist in terms of obtaining good results. Several surgical procedures have been suggested for this type of reconstruction, but the chances of success are limited by the small and constrained scaffolds which offer insufficient blood supply to the grafted tissue.

ANATOMY OF INTERDENTAL PAPPILA:

The gingival tissue extending from the incisal tip of the papilla to a line tangential to the gingival margins of the two adjacent teeth is known as the interdental papilla.[1]The gingiva's interdental papillae fill the spaces between adjacent teeth. The height of the alveolar bone, the space between the teeth, and the interdental contact point all have an impact on this dense connective tissue that is covered in epithelium.[8]The contact point can be found in different places in the anterior teeth. For instance, the incisal third of the labial aspect is where two central incisors make contact with each other.[9]The incisal third is where the central and lateral incisors make contact with each other. In the anterior region, it can be said that the interdental papilla between the two central incisors has more space than the other teeth.[9]

In a land mark study, Tarnow et al. measured the distance between the bone crest and the contact point in 30 patients and assessed whether interdental papillae were present or absent. 100% of cases where the distance was less than or equal to 5mm, 56% of cases where the distance was

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6mm, and only 27% of cases where the distance was 7mm or more had the papilla present.[10]
The inter-radicular distance smaller than 0.3mm puts the existence of the proximal bone in jeopardy and is typically associated with the absence of the interdental papilla, according to Fradeani, who also claimed that the distance between the roots is a factor that can affect the presence or absence of interdental papilla.[11]

CLASSIFICATION OF INTERDENTAL PAPILLA LOSS

Nordland and Tarnow (1998) proposed a classification system regarding the papillary height adjacent to natural teeth, based on three anatomical landmarks- The interdental contact point, the apical extent of the facial cementoenamel junction (CEJ), and the coronal extent of the proximal CEJ. [12]
Normal: Interdental papilla fills occupies the entire embrasure space apical to the interdental contact point/area.
Class I: Tip of interdental papilla is located between the interdental contact point and the level of the CEJ on the proximal surface of the tooth.
Class II: Tip of interdental papilla is located at or apical to the level of the CEJ on the proximal surface of the tooth but coronal to the level of CEJ mid buccally.
Class III: Tip of interdental papilla lies level with or apical to facial CEJ.

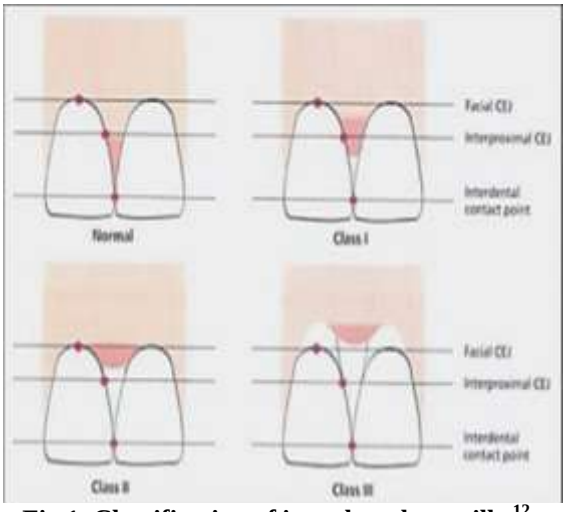

Fig 1. Classification of interdental pappilla [12]

PHOTOBIOMODULATION THERAPY(PBM):

LLLT is another name for low-level laser therapy. The use of photo biomodulation (PBM) therapy in dentistry and medicine is expanding, and it has drawn a lot of attention. Low-level photobiomodulation, also referred to as light therapy, is a non-invasive, non-thermal therapy that uses non-ionizing light sources, such as lasers, light-emitting diodes (LEDs), and broadband light in the visible and infrared spectrum. As a result, efforts to foster osseointegration employing physical, chemical, or biological means are gaining more attention.[13] One such method is photo biomodulation therapy (PBMT).[13]LLLT was discovered by Endre Mester at Semmelweis Medical University in 1967 at Hungary.[14]

With the goal to promote metabolic improvement and the stimulation of fibroblastic activity, photo biomodulation therapy (PBMT) was employed which have acquired further attention. [14]There is a great deal of research demonstrating the beneficial effects of photobiomodulation therapy (PBMT) at various levels of cell function, including protein synthesis, migration, differentiation, and release of growth factors.[15] All of these are crucial for tissue regeneration. A systemic review by Marques et al 2016 concluded that it has a beneficial impact on influencing survival, proliferation, migration, and differentiation of originated dentoalveolar stem cells.[15]

Hemolasertherapy (HLT), was introducedin the study done by zanin et al 2016.[1]This technique would give an edge over the conventional techniques as it is nonsurgical and simple to execute. HLT is the result of blood-based hemotherapy treatments, in which laser PBMT and patient blood drops are utilised on an area of interest.[1]Numerous in vitro studies using cell cultures have substantially improved our understanding of the processes leading up to the clinical effects of PBMT.[15]

In accordance to an in vitro study, the bleeding that occurred in the MSC-rich gingival area was what caused the blood clot to form. They need more stimuli to stay viable and differentiate further. The results of a combined regenerative therapy with PMBT through provoked bleeding are presented by the authors, who also examined the effects of provoked bleeding in the marginal gingival of patients with black spaces followed by PBMT. Even though PBMT would enhance MSC survival and differentiation, the blood clot would serve as a natural scaffolding for stem cells and growth factors found in blood platelets. When used in tissue engineering, PBMT displayed positive results.[1]

Clinical Case report

A 32-year-old female patient presented on July 2022 at the department of periodontics with the chief complaint of spacing between the upper

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front teeth causing a compromise in aesthetics since 2 years. Her medical history was non-contributory, with no known allergies. Thorough clinical and radiographic examination revealed that the patient presented with class 1 papilla (Norland and Tarnow classification 1998).[12] The interdental bone was within 5 mm from the contact point (fig1).A preoperative assessment of periodontal status was done to eliminate presence of inflammation, abnormal frenal attachment and adequate width of attached gingiva.

PROCEEDURE:

First Day:

Preoperative measurements of the interdental papilla between 11 and 21 was assessed.Radiographically the alveolar crest is assessed(Fig. 2 & Fig. 3). The height of each papillary defect was calculated as the angle between the interdental contact point and the papilla's tip. The base was calculated as the separation between the adjacent teeth's proximal surfaces at the papilla's tip. (Fig.4).

Fig 2. Preoperative view

Fig 3. Radiographic view

Fig 4. The 2-dimensional measurements of the interdental papilla

A tissue marker was used to mark the bleeding points on the gingiva after the topical anaesthetic agent had been applied. As shown in the image, there are three points per tooth and one point between the labial and lingual papilla. (Fig 5).

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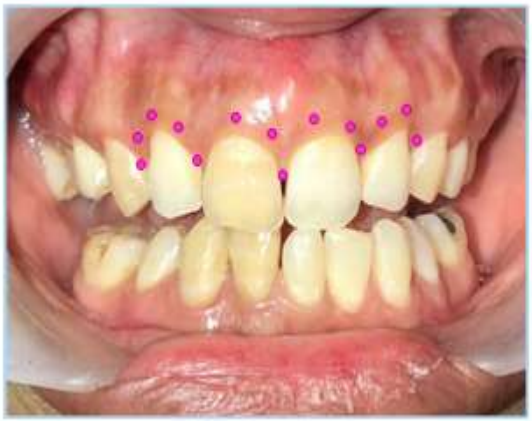

Fig 5. Three points marked per papilla for PBMT and for inducing bleeding.

With a diode laser of 810 nm, PBMT was applied twice: once before bleeding to stimulate the local microcirculation and once right after bleeding to stimulate the stem cells.

A diode laser with an output of 810 nm was used to illuminate each spot for 20 seconds at a power setting of 100 mW, producing a maximum energy of 2J per point (Fig. 6). The fibre tip was inserted into the interdental papilla at its base and exposed to radiation at the same power level.

Fig 6. Bio stimulating the spots marked

The laser parameters are:
Light source: Low-level diode laser
Wavelength: 810 nm
Power output: 100 mW, CW
Irradiation mode: Contact mode, punctual, in two steps/day
Spot area: 0.18 cm^2
Exposure time per point: 20 sec each area

In an attempt to accomplish healthy and stable gingival growth over the long term, laser bio stimulation could be used to increase blood microcirculation, encourage metabolic improvement, and promote fibroblastic activity.[16]

Bleeding was induced intrasulcularly with an explorer tip following initial PBMT. The interdental embrasure was left open for the blood to enter. (Fig7). The same power setting could be then used to irradiate the bleeding spots. (Fig 8).

Fig 7. Inducing bleeding intrasulcularly with explorer. The embrasure spaces are open to the blood's flow.

Fig 8. Laser biostimulation done to enhance the microcirculation

The patient was then instructed to take a fifteen-minute rest in the dental chair before being let go. After seven days, the patient was called back for a second hemolaser therapy session. On the seventh day as well, the procedure was completed, and aftercare instructions were given.

II. RESULTS:

Partial soft tissue coverage was obtained in the interdental papilla between Maxillary central incisors 11 and 21 after 3 weeks (Fig 9). Complete

closure of the papilla was achieved after 6 weeks(Fig 10).

Fig 9. Follow up after 3 weeks

Fig. Follow up after 6 weeks

III. DISCUSSION

The harmony of pink and white aesthetics remains the corner stone of meeting the increasing aesthetic demands of the modern era. Interdental papilla plays a major role in maintaining the pink aesthetics and thus beautifying one's smile. Loss of interdental papilla is a common periodontal problem. One of the most difficult goals in soft tissue regeneration is interdental papilla reconstruction. Although many surgical and non-surgical methods have been tried, the outcomes are still unpredictable. Hyaluronic acid application, orthodontic and restorative correction, and repeated curettage of the interdental papilla are examples of nonsurgical techniques. Surgical techniques include pedicle and free gingival grafts, connective tissue grafts, and subepithelial connective tissue grafts.[9]

The success depends on the elimination of the etiological factors before papillae can be reconstructed. Shapiro advocated a non-invasive strategy in 1985 by encouraging gingival tissue proliferation following repeated scaling and curettage.[17] Beagle combined the roll technique with the papilla preservation technique.[3] Han and Takei described the use of free soft tissue grafts for papillary augmentation, which involved coronal displacement of the gingival-papillary unit and implantation of a subepithelial connective tissue graft.[5] The majority of techniques are invasive and each merits and demerits. The field of regenerative medicine has undergone a revolutionary transformation with the creation of lasers. It has been applied to periodontal treatments and soft tissue regeneration area.

The use of laser by Cranka for the reconstruction of gingival papilla demonstrated good results.[18]Many research investigations have documented the impact of low-level diode laser on human gingival fibroblasts. It has also been discovered that diode laser irradiation can promote stem cell proliferation.[19,20] However, there is not much data to back up the use of hemotherapy and a diode laser in tandem to regenerate interdental papilla.

IV. CONCLUSION

The advantages of minimally invasive procedures include minimal discomfort and quick recovery. They are promising methods to replace missing interdental papillae. Due to its unpredictable results, interdental papilla regeneration has always been difficult. Surgical procedures appear to be more intricate and invasive. In terms of periodontal aesthetic surgery, photo biomodulation therapy was regarded as the most practical, patient-friendly, and non-invasive technique. The findings of this study indicate that photobiostimulation may be a useful mode of treatment for interdental papilla regeneration in areas with a high prevalence of black triangles.

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