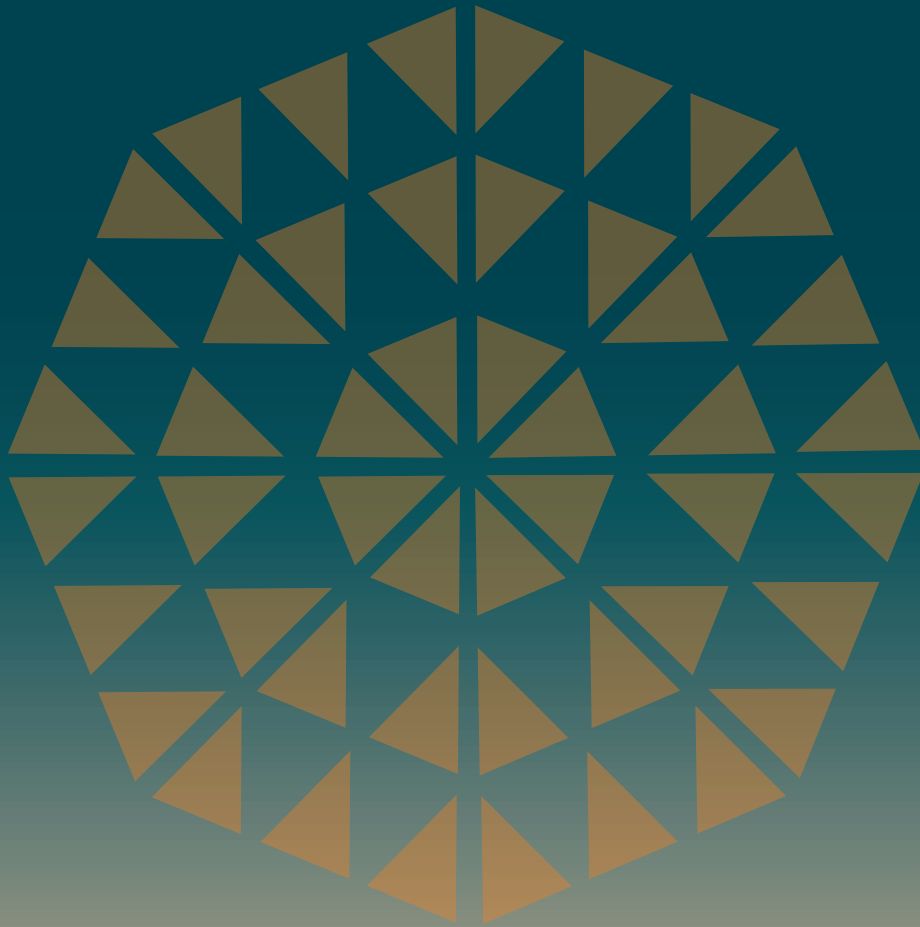


DENTAL BITES

Volume 9 Issue 1 | January - March 2022

Restorative and Reconstructive Dentistry



a quarterly publication of



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Restorative and Reconstructive Dentistry

a quarterly publication of



KMCT Medical College Campus, Mukkam, Kozhikode – 673602

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Editorial

“Life will only change when you become more committed to your dreams than you are to your comfort zone”. Change is inevitable; we are planning for positive change for our institutional journal. As we go high up, we should learn to be organized, systematic & committed. We are changing the face of our journal to four new issues with different topics of interest like

 **RESTORATIVE & RECONSTRUCTION DENTISTRY**

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Our institute provides equal opportunity for all, he who uses them effectively can conquer their dreams. It's my pleasure & privilege to introduce & congratulate our new editorial board before you and I request all of you to use this opportunity effectively.

Our dedicated and concerted effort culminated into a desire to present a state of the digital library with all its requisites to enrich and enlighten your knowledge. This institution should continue its efforts to provide medical education with latest innovations to students by updating the syllabus with fast changing technological and medical devices and equipment. It is essential to teach new medical diagnostic techniques and treatment to ignite the students with a mission to serve, share and heal the poor people's sufferings and pains.

*Our aim importantly is to make education fun filled enjoyable learning and growing experience on the solid foundation of values. We believe it is important to create an environment where students look eagerly forward to come to college. We want them to have fond memories of their time spent with us long after they have left the portals of the college. **“Be what you want to be, not what others want to see”.***

Dr Manoj Kumar KP

Editor

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Original Research

ASSESSMENT OF BIODENTINE PULPOTOMY AS AN ALTERNATIVE TO CONVENTIONAL ROOT CANAL TREATMENT FOR PERMANENT TEETH IN CHILDREN-A PILOT STUDY

*Dr Amith Adyanthaya, **Dr Mubeena T.A, ***Dr Gopika Gopan, **Dr Preema M.U

Abstract

Background

Vitality of dental pulp is essential for long term survival of teeth. Preservation of pulp vitality is essential in maintaining vascularity and nutrition of the tooth that eventually will support tooth structure and reduce tooth mortality. Root canal treatment for permanent teeth in children is a complex procedure requiring lengthy appointments and multiple visits and often require a full coverage restoration. On the other hand, vital pulpotomy requires shorter appointments and usually accomplished in one visit. This study evaluated biodentine total pulpotomy as an effective alternative to conventional endodontic therapy for permanent tooth.

Aim

To assess the clinical and radiographic outcome of biodentine in complete coronal pulpotomy of permanent teeth with symptomatic reversible pulpitis.

Methodology

Full coronal pulpotomy was performed in a total of 10 permanent molars diagnosed with acute reversible pulpitis using biodentine as the pulpotomy medicament. Follow up evaluation was done clinically and radiographically at 3, 6 and 9 months.

Result

The teeth with acute reversible pulpitis treated by biodentine pulpotomy showed considerable clinical and radiographic success. Both the overall clinical and radiographic success rate was found to be 90%.

Conclusion

Biodentine as a pulpotomy agent has a high successful rate clinically and radiographically in the treatment of permanent tooth with acute reversible pulpitis in children.

Key words; *Biodentine, Coronal pulpotomy, Permanent teeth, Total pulpotomy*

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Introduction

The dental pulp is an integral element of tooth structure. A vital pulp tissue is responsible for supporting the tooth structure through reparative dentine production. Preserving pulp vitality is essential in maintaining vascularization and nutrition to the tooth that eventually will support tooth structure and reduce tooth mortality.

Root canal treatment for permanent teeth in children is a complex procedure requiring lengthy appointments and multiple visits. On the other hand, vital

pulpotomy requires shorter appointments and usually can be accomplished in one visit. By providing an alternative to the conventional RCT in children, vital pulp therapy can help retain vital permanent teeth that are able to withstand normal functions. In a recently published systematic review, authors concluded that vital pulp therapy should be considered as an alternative treatment to RCT in vital permanent teeth with carious exposed pulp.¹

Studies have also shown high

success rates for vital pulp therapy in maintaining the vitality of dental pulp tissues in young permanent teeth with open root apices. On the other hand, for teeth with closed root apices, the best treatment option under similar pulpal conditions is RCT.

Ricucci et al² in a 5-year prospective study reported an overall success rate of 89% for conventional RCT in 816 teeth. However, endodontic treatment for mature molar teeth has been reported to increase the incidence of tooth fractures.³ This is usually due to the loss of tooth structure and induced stresses caused by endodontic and restorative procedures which will eventually weaken the tooth and make it more susceptible to fracture. Therefore, maintaining tooth vitality enhances dentinal root deposition and results in stronger root structure.³

The aim of vital pulpotomy in permanent teeth of children is to treat reversible pulpal injuries and to maintain radicular pulp vitality and function and thereby maintain the tooth in a viable condition.⁴

Pulpotomy is a vital pulp therapy in which the coronal portion of the pulp is removed

surgically and the remaining radicular pulp is preserved intact. Over the remaining radicular pulp tissue, a suitable material is placed which has the potential to protect the pulp from further insult and initiate healing and repair.⁵

The rationale behind pulpotomy procedures is based on the ability of the remaining radicular pulp to recover following the removal of the infected coronal pulp tissue and placement of a suitable medicament.⁶ Various materials have been advocated for use in pulpotomy procedures based on their important properties such as biocompatibility, sealing ability, and antimicrobial efficacy when placed in contact with the inflamed pulp.⁷

This study was conducted to evaluate whether biodentine total pulpotomy is an effective alternative to conventional endodontic therapy for permanent teeth in children.

Methods

This is a cross-sectional study conducted in the Department of Paediatric and Preventive dentistry, KMCT dental college, Mukkam, Calicut. The duration of

the study was 12 months from Feb 2021 - Feb2022. 10 children below the age of 13 years with at least one permanent molar tooth having carious exposure were selected. After clinical examination preoperative pulpal and the periapical diagnosis was established.

Inclusion criteria:

1. Permanent molar tooth with deep caries and a diagnosis of symptomatic reversible pulpitis
2. Absence of tenderness to percussion.
3. Absence of physiologic or pathologic tooth mobility.

Exclusion criteria:

1. Clinical evidence of pulpal inflammation or degeneration such as history of swelling or presence of sinus tract.
2. Radiographic evidence of internal or external root resorption, pulpal calcifications, or osseous disease (periapical /furcation radiolucency).
3. Teeth with periodontal pathology.
4. Non vital teeth.

Each patient and his/her parents were

explained in detail about the risks of the treatment. Briefing about the advantages, disadvantages and complications of the procedure was done. Written informed consent was obtained from the parents for the procedure and for follow up.

All the procedures were carried out by a single operator. The tooth was subjected to local anaesthesia with 2 % lidocaine (1:80000 epinephrine). After achieving proper anaesthesia isolation of the field was done by the rubber dam (Optra Dam, Ivoclar Vivadent). Removal of the carious lesion was done using a high-speed airtor handpiece with adequate water coolant. After gaining access to the pulp chamber the status of pulpal bleeding was assessed. Presence of pulpal bleeding on entry to the pulp chamber was considered as the most important inclusion criterion for this case series. Pulp chamber was deroofed and the coronal pulpal tissue was removed using sharp excavator till the canal orifices. Pulpal bleeding was controlled by the placement of sterile moist cotton pellet for about 3 - 5 minutes. Biodentine was mixed by strictly following the manufacturer's instructions. The mixed material was placed on the floor of the pulp chamber at the root

canal orifices in a thickness of approximately 2 - 3 mm. After setting of Biodentine the cavity was sealed using Zinc oxide eugenol cement. Clinical symptoms were evaluated for 3 weeks and if negative the Zinc oxide cement in the pulp chamber was removed partially and was replaced with the permanent restoration.

Outcome Measures

All the patients involved in the study were continuously evaluated clinically and radiographically at the end of 3 months, 6 months and 9 months.

The outcome of the treatment was considered successful in the –

1. Absence of any reported clinical signs and symptoms including pain
2. Absence of tenderness to percussion,
3. Absence of sinus tract or swelling
4. Absence of any pathologies evident on radiographs taken at follow up visits including root resorption, new furcal lesions or signs of any periapical rarefaction.

Results

In this clinical study, a single procedure was carried out without any comparison group. Out of the 10 cases, all except one were reported successful.

Ten patients in the clinical study included 2 boys and 8 girls. Age of the patients included in the study ranged from 9 to 13 years. All the patients included in the study had deep caries with signs of reversible pulpitis. Clinical and radiographic examination during the follow - up periods revealed that 9 out of 10 patients were asymptomatic throughout the follow-up periods. There were no reported clinical signs / symptoms including pain, swelling, presence of sinus and tenderness to percussion

Only one patient complained of acute pain 1 month after the procedure and subsequently required root canal treatment. This case was considered as a clinical failure.

Out of 10 samples overall clinical and radiographic success was found to be 90%

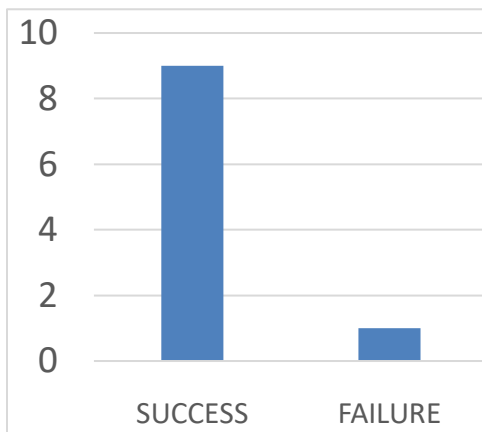


Fig 1- Representative Intraoral Periapical Radiograph



Figure 2: (a)Preoperative Radiographs of 46 of a 9-Year-Old Female Patient (b) After Biodentine Coronal Pulpotomy (c) Follow up Radiographs at 6 months (d) Follow up radiograph at 9 months

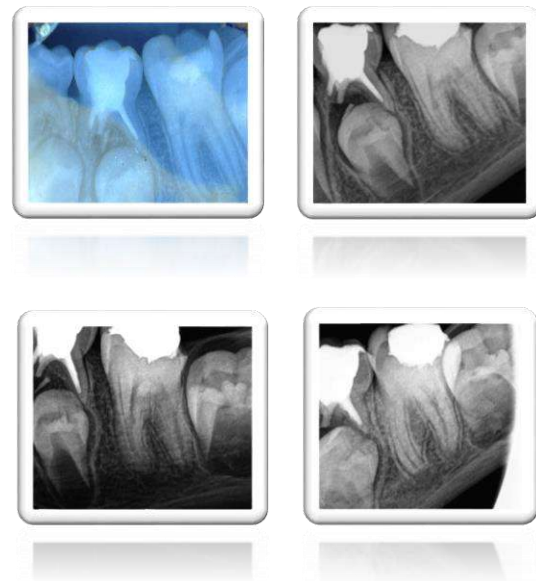


Figure 3: (a)Preoperative Radiographs of 46 of a 9-Year-Old Female Patient (b) After Biodentine Coronal Pulpotomy (c) Follow Up Radiographs at 6 months (d) Follow up radiograph at 9 months

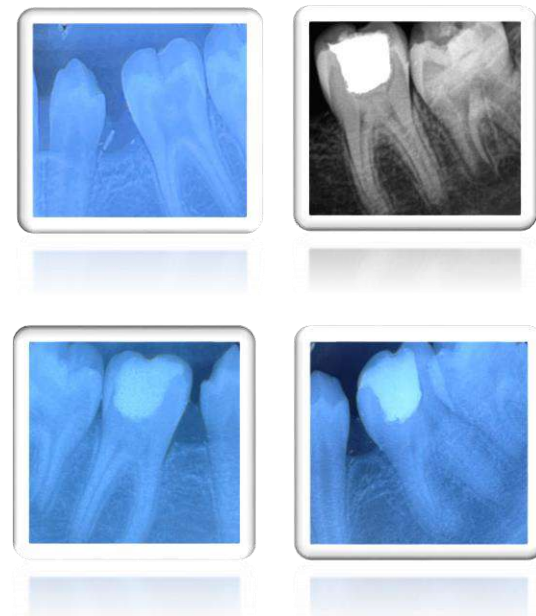


Figure 4: (a)Preoperative Radiographs of 46 of a 9-Year-Old Female Patient (b) After Biodentine Coronal Pulpotomy (c) Follow up Radiographs at 6 months (d) Follow up radiograph at 9 months

36 of a 9-Year-Old male Patient (b) After Biodentine Coronal Pulpotomy (c) Follow Up Radiographs at 6 months (d) follow up radiograph at 9 months

Discussion

Clinically, a major challenge faced by most paediatric dentists, endodontists or general dentists with special interest in treating children is the treatment of pulpally involved and abscessed teeth in a young patient. This is mainly due to factors related to patient's cooperation, the total number of visits required to finish the treatment and the cost of treatment. This is further complicated by disagreement on treatment protocols and outcomes among clinicians, which is often based on little or no documented evidence.⁸

It has long been known that healthy dental pulp cells have the potential to develop into odontoblasts.⁹ This allows pulp tissue to regenerate and repair.^{9,10} Authors suggested that aged pulp retains the ability to create dentine but at a diminished rate. They also concluded that younger pulps had a better likelihood of potential tissue healing and regeneration.^{11,12} An explanation for this could be provided from a recent review on

dental pulp stem cells where the authors demonstrated that ageing was related to reduction of pulpal cell populations leading to compromised pulpal wound healing and regeneration with increasing age.¹³

Recent studies have shown high success rates for vital pulp therapy in maintaining the vitality of dental pulp tissues in young permanent teeth with open root apices. On the other hand, for teeth with closed root apices, the best treatment option under similar pulpal conditions is RCT. Ricucci et al,¹⁴ in a recent 5-year prospective study reported on an overall success rate of 89% for conventional RCT in 816 teeth. However, endodontic treatment for mature molar teeth has been reported to increase the incidence of tooth fractures. This is usually due to the loss of tooth structure and induced stresses caused by endodontic and restorative procedures which will eventually weaken the tooth and make it more susceptible to fracture. Therefore, maintaining tooth vitality enhances dentinal root deposition and results in stronger root structure.¹⁵

The aim of vital pulpotomy in permanent teeth in children is to treat reversible pulpal injuries and to maintain

radicular pulp vitality and function and therefore maintain the tooth in a viable condition. Recent clinical studies on direct pulp capping and partial pulpotomy in treating cariously exposed permanent teeth have supported the concept that dental pulp has the ability to remain vital after removing infected pulp tissue.

The treatment of a diseased pulp in the initial stages is to remove the most severely inflamed and infected coronal pulp tissue followed by placement of a proper biocompatible pulp dressing material. A bioactive pulp dressing with healing ability can potentially conserve the vitality of the remaining healthy pulp tissues by promoting healing. On the contrary, if the pulpal tissue is inflamed beyond possible repair, treatment with partial removal of pulp will eventually fail. The patient will either present with the reappearance of the symptoms or they even development new periapical lesion.¹⁶

Biodentine, which is biocompatible and bioactive dentin substitute that induces mineralization by enhancing the secretion of TGF- β 1 from pulpal cells following its application. It also acts by increasing odontoblastic stimulation and rapid cell

differentiation which leads to reactionary and tertiary dentin formation.¹⁷ Biodentine also induces immortalized murine pulp cell differentiation into odontoblast like cells which further induces mineralization and can therefore be a suitable material for dentin-pulp complex regeneration.¹⁸ Because of its high alkalinity, Biodentine has inhibitory effects on microorganisms and has shown strongest antibacterial activity against *Streptococcus Sanguis*. Other well-known advantages are its easy manipulation, smooth consistency with optimum working and setting time of about 12 minutes, compressive strength of 220 MPa which is nearly close to that of dentin (290 MPa), good marginal integrity and an enhanced sealing ability which makes it superior to previously introduced calcium silicate materials.¹⁸

Caries progression into deeper tissues of the pulp can cause degenerative and inflammatory processes resulting in necrosis of the pulp and apical periodontitis. In a carious pulp exposure, there is a coexistence of damaged and healthy pulp histologically in various parts within the same pulp. Proper evaluation of the extent of tissue injury of the pulp plays

a major role in the successful prediction of pulpotomy treatment. The intensity of bacterial infection influences the inflammatory and immune response also. Clinically, it is not easy to accurately determine the extent of disease progression in the pulp tissue and hence, removal of the diseased tissue may not be complete and can contribute to the failure of such cases¹⁹.

Adoption of vital pulp therapy is depended upon a thorough understanding of the pulp biology and the regenerative and healing potential of the remaining pulp tissue. Actual histologic features and potential capability of the pulp to heal can be in a way predicted by the clinical signs and symptoms like the degree of pain²⁰. Matsuo et al. suggested that observing the degree of pulpal bleeding was more reliable than preoperative clinical signs and symptoms in providing a better idea of the histologic condition of the pulp. If the pulpal bleeding presents to be controllable it is indicative of a mild inflammation or chronic partial pulpitis without areas of necrosis. Meanwhile, if the pulp presents with profuse bleeding which appears difficult to control the pulp tissue it is assumed to be severely inflamed.

Even though Aguilar and Linsuwanont¹ observed those younger patients have a higher success in vital pulp therapy there are reports of successful vital pulp therapy in patients as young as 6 years to 70 years. This throws light to the fact that the healing capacity of pulp is present even in older patients if there is proper removal of the cause of the disease. This is explained to be because of subjective variation in the innate capacity of pulp tissue for repair in the absence of microbial contamination. Aguilar and Linsuwanont have reported 99.4 % and 99.3 % success rate for partial pulpotomy in vital permanent teeth with closed apices.

Definite success factors for treatment outcome of a pulpotomy is not published in any review yet. Most of the published data is limited to clinical studies with a smaller number of participants.

The high success rate in this case series is attributed to the careful attention given to the case selection, maintenance of proper isolation and to the methods used to prevent pulpal bleeding and cavity closure.

Conclusion

The present study showed that Biodentine is proved to be used as an effective medicament for total pulpotomy of permanent teeth with reported signs and symptoms of reversible pulpal damage, relieving associated pulpal symptoms and preserving pulp vitality. Henceforth coronal pulpotomy shall be considered as an option for treatment of permanent teeth in certain circumstances. Although the results are in favour of coronal pulpotomy as a treatment of the permanent tooth, the literature calls for clinical trials with larger sample size and a longer follow up period to justify the use of Biodentine for permanent teeth.

References

1. Aguilar P, Linsuwanont P. Vital pulp therapy in vital permanent teeth with cariously exposed pulp: a systematic review. *Journal of endodontics*. 2011 May 1;37(5):581-7.
2. Ricucci D, Russo J, Rutberg M, Burleson JA, Spångberg LS. A prospective cohort study of endodontic treatments of 1,369 root canals: results after 5 years. *Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology, and Endodontology*. 2011 Dec 1;112(6):825-42.
3. Tang W, Wu Y, Smales RJ. Identifying and reducing risks for potential fractures in endodontically treated teeth. *Journal of endodontics*. 2010 Apr 1;36(4):609-17.
4. Alqaderi HE, Al-Mutawa SA, Qudeimat MA. MTA pulpotomy as an alternative to root canal treatment in children's permanent teeth in a dental public health setting. *Journal of dentistry*. 2014 Nov 1;42(11):1390-5.
5. Eghbal MJ, Asgary S, Baglue RA, Parirokh M, Ghoddusi J. MTA pulpotomy of human permanent molars with irreversible pulpitis. *Australian Endodontic Journal*. 2009 Apr;35(1):4-8.
6. Asgary S, Ehsani S. Permanent molar pulpotomy with a new endodontic cement: A case series. *Journal of conservative dentistry: JCD*. 2009 Jan;12(1):31.
7. Camilleri J. Investigation of Biodentine as dentine replacement

- material. *Journal of dentistry*. 2013 Jul 1;41(7):600-10.
8. Alqaderi HE, Al-Mutawa SA, Qudeimat MA. MTA pulpotomy as an alternative to root canal treatment in children's permanent teeth in a dental public health setting. *Journal of dentistry*. 2014 Nov 1;42(11):1390-5.
 9. Huang GT. A paradigm shift in endodontic management of immature teeth: conservation of stem cells for regeneration. *Journal of dentistry*. 2008 Jun 1;36(6):379-86.
 10. Tziafas D. The future role of a molecular approach to pulp-dentinal regeneration. *Caries research*. 2004;38(3):314-20.
 11. Matsuzaka K, Muramatsu T, Katakura A, Ishihara K, Hashimoto S, Yoshinari M, Endo T, Tazaki M, Shintani M, Sato Y, Inoue T. Changes in the homeostatic mechanism of dental pulp with age: expression of the core-binding factor alpha-1, dentin sialoprotein, vascular endothelial growth factor, and heat shock protein 27 messenger RNAs. *Journal of Endodontics*. 2008 Jul 1;34(7):818-21.
 12. Holland GR, Torabinejad M. The dental pulp and periradicular tissues. *Endodontics-E-Book: Principles and Practice*. 2008 Mar 10:1.
 13. Sloan AJ, Waddington RJ. Dental pulp stem cells: what, where, how? *International Journal of Paediatric Dentistry*. 2009 Jan;19(1):61-70.
 14. Ricucci D, Russo J, Rutberg M, Burleson JA, Spångberg LS. A prospective cohort study of endodontic treatments of 1,369 root canals: results after 5 years. *Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology, and Endodontology*. 2011 Dec 1;112(6):825-42.
 15. Tang W, Wu Y, Smales RJ. Identifying and reducing risks for potential fractures in endodontically treated teeth. *Journal of endodontics*. 2010 Apr 1;36(4):609-17.
 16. Rajasekharan S, Martens LC, Cauwels RG, Verbeeck RM. Biodentine™ material characteristics and clinical

- applications: a review of the literature. *European archives of paediatric dentistry*. 2014 Jun;15(3):147-58.
17. Zanini M, Sautier JM, Berdal A, Simon S. Biodentine induces immortalized murine pulp cell differentiation into odontoblast-like cells and stimulates biomineralization. *Journal of endodontics*. 2012 Sep 1;38(9):1220-6.
 18. Eghbal MJ, Asgary S, Baglue RA, Parirokh M, Ghoddusi J. MTA pulpotomy of human permanent molars with irreversible pulpitis. *Australian Endodontic Journal*. 2009 Apr;35(1):4-8.
 19. Bjørndal L. The caries process and its effect on the pulp: the science is changing and so is our understanding. *Journal of endodontics*. 2008 Jul 1;34(7):S2-5.
 20. Matsuo T, Nakanishi T, Shimizu H, Ebisu S. A clinical study of direct pulp capping applied to carious-exposed pulps. *Journal of endodontics*. 1996 Oct 1;22(10):551-6.

Review

EBC CONCEPT IN PROSTHODONTICS

*Dr. Sheejith M, **Dr. Varennya R, **Dr. Neeraja.E.V, ***Dr. Swapna C, ****Dr. Arun Rajendran

Abstract

The biological seal of the soft tissue-implant interface is created by epithelium and connective tissue. The presence of keratinized mucosa surrounding an implant is thought to be one of the important factors in maintaining peri-implant soft tissue health. However, the peri-implant soft tissue complex lacks Sharpey's fibers, thus offering less resistance to clinical probing and biofilm penetration compared to the natural dentition. Therefore, the proper restorative emergence profile design is essential to facilitate favorable esthetic outcomes and maintain peri-implant health. The EBC concept considers specific parameters for proper design of the emergence profile of implant-supported restorations. Understanding the different zones of the emergence profile and their relation to factors like implant position, implant design, and soft tissue thickness is the key. The purpose of this review is to understand the importance and specific design features of the EBC zones, which facilitates esthetic and biologically sound treatment outcomes.

A Pub Med/MEDLINE search was conducted to gather available reports. A total of 21 articles were included which described about the emergence profile.

Key words; *Emergence profile, Esthetic dentistry, Dental implants*

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Introduction

Dental implant treatment involves multiple factors that must be considered for long term success. One critical factor is the emergence profile of the implant. The emergence profile has implications in esthetics for recreating a natural profile of the missing tooth being replaced and it also affects the periodontal health of the surrounding soft tissue and, ultimately, the underlying bone. When the emergence profile is unnatural in contour for the space being treated, food entrapment may result making patient homecare a challenge. Long-term success of treatment depends on optimal implant position in addition to maintenance of soft-tissue health.^[1]

Emergence profile can be defined as the contour of the tooth or restoration as it emerges from the gingiva. With dental implants, it is the contour of an implant restoration as it emerges from the implant platform. The emergence profile dictates the transformation of a dental implant into a natural-looking tooth.^[2] It can be challenging to replicate not only the crown portion of the tooth but also the entire tooth anatomy. The cross-section of teeth at the gingival margin has various shapes, such as

triangular, rhomboidal, and ovoid, depending on the type of tooth it is. The challenge arises because implants are round in cross-section at the platform and the clinician needs to transition to the specific shape of the natural tooth to provide natural-looking esthetics that mimic the profile of the tooth.^[1] This article describes the esthetic biological contour concept (EBC) and explains the different areas of the emergence profile to help create an esthetic and biologically oriented contour of implant-supported restorations.

Methods

A PubMed/MEDLINE search was conducted using the terms “emergence profile”, “dental implants”, “esthetic dentistry”. 148 articles dated between 1991 to 2022 were found in the search, out of which 127 were excluded because they did not match with the review criteria. 21 articles were found relevant for the study.

Ideally, the Implant restorative emergence profile contour should mimic that of the extracted tooth while supporting a harmonious, esthetic gingival architecture that mimics the surrounding natural dentition.

Emergence profile zones

There are three zones in sub gingival contour of the emergence profile of an implant restoration (Figure 1). Each of these zones will be in contact with a specific type of tissue and its design will have a different function. ^[3]

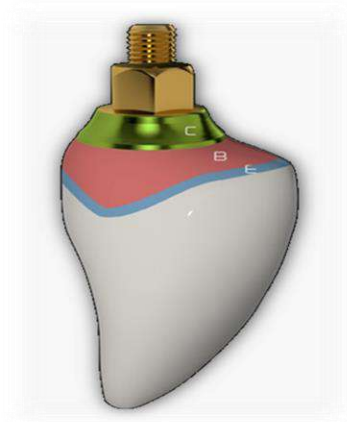


Fig 1: Emergence profile zones

E-ZONE [ESTHETIC ZONE]

The esthetic zone is the 1 mm sub gingival area, apical to the free gingival margin (FGM). This area is also called as critical contour area as it has to match with the previously extracted natural tooth or the contra lateral teeth. ^[4] Gingival tissue corresponding to E zone is made up of sulcular epithelium. This zone helps in esthetic conditioning and it will influence the FGM position and its direct relation to

the appearance of the implant restorations and surrounding tissue position.

B-ZONE [BOUNDED ZONE]

This area is apical to the E zone and is 3–4 mm below the restorative zenith point.^[5] It is approximately 1–2 mm and is significantly affected by the quantity of the soft tissues and the implant position. Gingival tissue corresponding to this area is made up of junctional epithelium. It serves as biologic boundary area.

C –ZONE [CRESTAL ZONE]

The C zone is the 1–1.5 mm area located immediately coronal to the implant platform.^[6,7] The apico-coronal dimension can vary depending on the depth of the implant. Gingival tissue corresponding to this area is connective tissue. This zone helps in crestal bone stability.

Decision tree

An ideal design for an implant restoration is a bit of misnomer since it is specific and custom-made for each individual implant. However it is necessary to follow certain guidelines while designing implant restorations. For the ease of understanding, the emergence profile zones have been

divided into two contour areas i.e. critical and subcritical contour area where E zone comes under critical contour area and B & C zones together under subcritical contour area. Critical contour should be consistent circumferentially from the FGM to approximately 1.5 mm apically. Since it determines the gingival margin architecture and thus the esthetic outcome, the critical contour should be ideally developed to mimic the contra-lateral tooth, regardless of implant position. The subcritical contour extends from the implant platform to the

base of the critical contour with a vertical extension of 0.5 to 1.0 mm.^[2] Whenever possible, the subcritical contour should provide a gradual and harmonious transition from the implant platform to the critical contour. This, however, requires sufficient implant depth between the crest of the soft tissue gingiva and the implant platform. Based on the available evidence, a decision tree was made to illustrate the design of critical and subcritical contours- (Table-1)

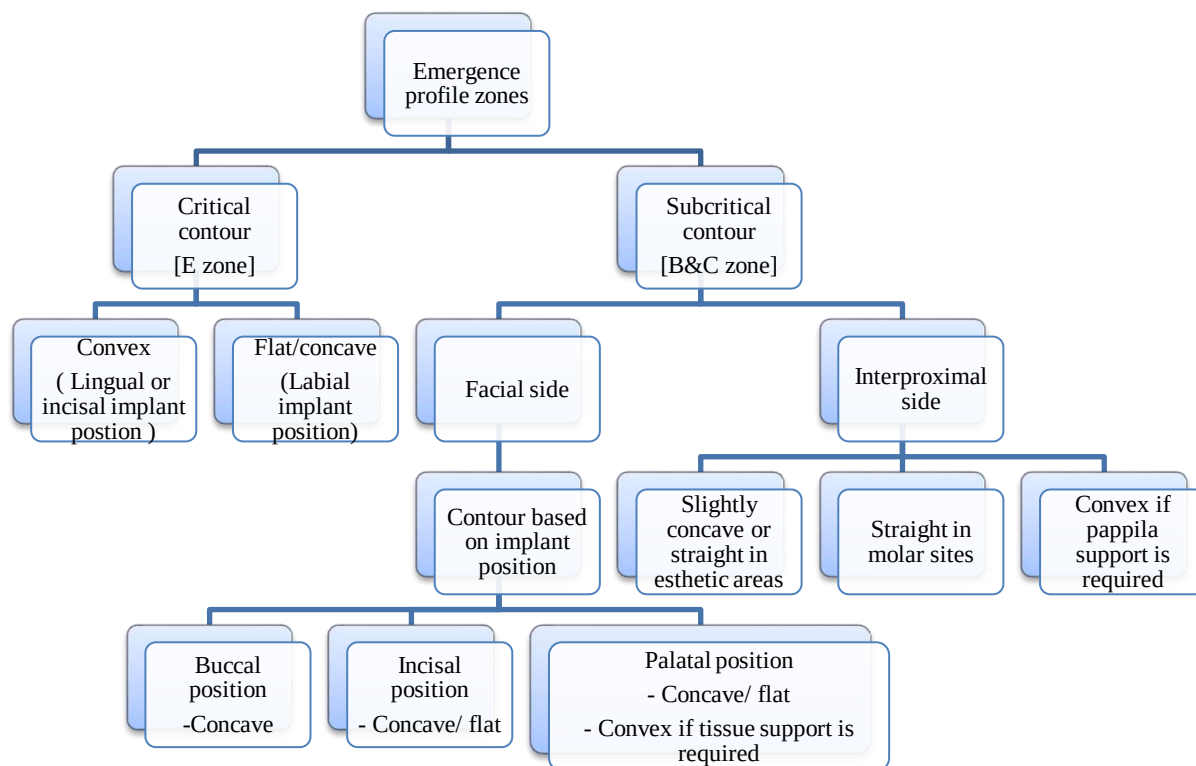


Table 1: Design of critical and subcritical contours

The critical contour is usually convex, following the cervical morphology of the anatomical crown. The degree of convexity will vary depending on implant position.^[8] The use of a straight or concave critical contour profile may be required in cases of excessive labial implant placement or angulations. This situation should be avoided with correct planning and the use of accurate surgical guides during implant placement.^[9] Leaving this area concave will cause loss of soft tissue support and inadequate appearance of the margin. If the convexity in this area is excessive, it will cause the margin to migrate apically.

The subcritical contour should be flat or concave (under-contoured) for a facially positioned implant to decrease pressure to the facial gingiva and/or increase the thickness of the peri-implant soft tissues. It should be slightly concave to flat for an incisally positioned implant, but it can be over contoured (convex) to support the gingival tissue, if needed.^[10]

Interproximally, the subcritical contour is slightly concave or straight in the esthetic zone.^[11-13] In some rare occasions; a convex subcritical contour may be used if papillary

support is required. The interproximal emergence profile design should not be over contoured to avoid pressure on neighboring hard and soft tissues that may lead to pain, bone resorption, and subsequent papilla loss.^[14] If the tissues are deficient, a connective tissue graft may be required to enhance the gingival phenotype as well as promote crestal stability and an esthetic result.^[15] Without a connective tissue graft, a convex design in this zone can help create the illusion of thicker tissues. It is essential to understand that the supra-crestal connective tissue is present in this zone, and over contouring the provisional should be avoided to maintain the integrity of these tissues and prevent bone remodeling.

CONCLUSION

Based on the currently available literature, a lack of convincing evidence is noted in terms of the ideal implant-restorative emergence design. Theoretically, the critical (E-zone) and subcritical contours (B&C-zone) of the crown/abutment complex should mimic the anatomical tooth/root shape as much as possible to provide adequate tissue support. However,

restorative emergence profile is highly dependent upon implant position and periodontal phenotype. Each of the zones described in the EBC concept have a specific function in the design of adequate emergence profiles in implant abutments. Understanding the importance and specific design features of the EBC zones and following the proposed guidelines facilitate esthetic and biologically sound treatment outcome.

References

1. Bishara M, Kurtzman GM, Krause ES. Implant Restorations: Establishing a Proper Emergence Profile. Compendium. 2020 Sep;41(8).
2. Chu SJ, Kan JY, Lee EA, Lin GH, Jahangiri L, Nevins M, Wang HL. Restorative emergence profile for single-tooth implants in healthy periodontal patients: clinical guidelines and decision-making strategies. Int J Periodontics Restorative Dent. 2019 Jan 1;40(1):19-29.
3. Gomez-Meda R, Esquivel J, Blatz MB. The esthetic biological contour concept for implant restoration emergence profile design. Journal of Esthetic and Restorative Dentistry. 2021 Jan;33(1):173-84.
4. Su H, González-Martín O, Weisgold A, Lee E. Considerations of implant abutment and crown contour: critical contour and subcritical contour. International Journal of Periodontics & Restorative Dentistry. 2010 Jul 1;30(4).
5. Esquivel J, Meda RG, Blatz MB. The Impact of 3D Implant Position on Emergence Profile Design. International Journal of Periodontics & Restorative Dentistry. 2021 Jan 1;41(1).
6. Moon IS, Berglundh T, Abrahamsson I, Linder E, Lindhe J. The barrier between the keratinized mucosa and the dental implant: An experimental study in the dog. Journal of clinical periodontology. 1999 Oct;26(10):658-63.
7. Abrahamsson I, Berglundh T, Glantz PO, Lindhe J. The mucosal attachment at different abutments: An experimental study in dogs. Journal of clinical periodontology. 1998 Sep;25(9):721-7.
8. Testori T, Weinstein T, Scutellà F, Wang HL, Zucchelli G. Implant placement in the esthetic area: criteria for positioning single and multiple implants. Periodontology 2000. 2018 Jun;77(1):176-96.

9. Ganz SD. Presurgical planning with CT-derived fabrication of surgical guides. *Journal of oral and maxillofacial surgery*. 2005 Sep 1;63(9):59-71.
10. Infante L. Facial gingival tissue stability following immediate placement and provisionalization of maxillary anterior single implants: a 2-to 8-year follow-up. *Int J Oral Maxillofac Implants*. 2011 Jan;26(1):179-87.
11. Patil R, den Hartog L, Dilbaghi A, de Jong B, Kerdijk W, Cune MS. Papillary fill response in single-tooth implants using abutments of different geometry. *Clinical Oral Implants Research*. 2016 Dec;27(12):1506-10.
12. Patil R, Gresnigt MM, Mahesh K, Dilbaghi A, Cune MS. Esthetic evaluation of anterior single-tooth implants with different abutment designs—Patients’ satisfaction compared to dentists’ observations. *Journal of Prosthodontics*. 2017 Jul;26(5):395-8.
13. Patil R, van Brakel R, Iyer K, Huddleston Slater J, de Putter C, Cune M. A comparative study to evaluate the effect of two different abutment designs on soft tissue healing and stability of mucosal margins. *Clinical oral implants research*. 2013 Mar;24(3):336-41.
14. Redemagni M, Cremonesi S, Garlini G, Maiorana C. Soft tissue stability with immediate implants and concave abutments. *Eur J Esthet Dent*. 2009 Dec 1;4(4):328-37.
15. Thoma DS, Naenni N, Figuero E, Hämmerle CH, Schwarz F, Jung RE, Sanz-Sánchez I. Effects of soft tissue augmentation procedures on peri-implant health or disease: A systematic review and meta-analysis. *Clinical oral implants research*. 2018 Mar;29:32-49.
16. POTASHNICK SR. Soft tissue modeling for the esthetic single-tooth implant restoration. *Journal of Esthetic and Restorative Dentistry*. 1998 May;10(3):121-31.
17. Cooper LF. Objective criteria: guiding and evaluating dental implant esthetics. *Journal of Esthetic and Restorative Dentistry*. 2008 Jun;20(3):195-205.
18. Su H, González-Martín O, Weisgold A, Lee E. Considerations of implant abutment and crown contour: critical contour and subcritical contour. *International Journal of Periodontics & Restorative Dentistry*. 2010 Jul 1;30(4).

19. Puisys A, Linkevicius T. The influence of mucosal tissue thickening on crestal bone stability around bone-level implants. A prospective controlled clinical trial. Clinical oral implants research. 2015 Feb;26(2):123-9.
20. Zuiderveld EG, Meijer HJ, den Hartog L, Vissink A, Raghoobar GM. Effect of connective tissue grafting on peri-implant tissue in single immediate implant sites: a RCT. Journal of clinical periodontology. 2018 Feb;45(2):253-64.
21. Bain CA, Weisgold AS. Customized emergence profile in the implant crown-a new technique. Compendium of Continuing Education in Dentistry (Jamesburg, NJ: 1995). 1997 Jan 1;18(1):41-5.

Literature Review

CONVERSION OF “NANO” TO “SMILES”: RECENT ADVANCES OF NANOTECHNOLOGY IN CONSERVATIVE DENTISTRY AND ENDODONTICS

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Abstract

Nanodentistry implies the application of nanomaterial and dental nanorobots toward diagnosis and treatment, with the goal of improving comprehensive oral health. In the field of endodontics, the development of nanomaterials is focused on steps that would improve antimicrobial efficacy. The current study undertakes review to assess the effectiveness of different nanoparticles irrigation systems to improve the antibiofilm efficacy in root canal. Application of nanoparticles in the form of solution for irrigation, medication, and as an additive for sealer/restorative material has been evaluated to primarily improve the antibiofilm efficacy in root canal; in addition, the functionalized nanoparticles can provide better antibacterial effect. Nanoparticles-based treatment strategies have the potential to improve antibacterial/antibiofilm efficacy in endodontics. Thus, the increasing interest in this field warrants sound research based on scientific and clinical collaborations to emphasize the future potential of nanoparticles in clinical endodontics.

Keywords: *Chitosan nanoparticles, bio active nanoparticles, silver nanoparticles*

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Introduction

Nanotechnology has revolutionized all aspects of health including the dentistry. Nanomaterial denotes a natural, incidental,

or manufactured material containing particles in an unbound state or as an aggregate or agglomerate in which 50% or more of the particles in number, size,

distribution, or 1 or more external dimensions is in the size range of 1–100 nm.¹

The term nanotechnology was first introduced by Richard Feynman in 1959 to the scientific approach of creating functional materials, devices and systems through control of atoms on a nanometer scale and exploitation of novel phenomena and properties at that length scale. This was practically made possible by Eric Drexler in the mid-1980s when he emphasized the potential of molecular nanotechnology. The term “Nano” is derived from the Greek word “dwarf”. More simply speaking, one nanometer is one-billionth or 10^{-9} of a meter.

Nanotechnology has progressed rapidly in science and technology, creating a myriad of biomedical applications such as drug delivery, tissue regeneration, antimicrobial application, gene transfection, and imaging.^{2,3,4,5} The term nanodentistry implies the application of nanomaterials and dental nanorobots toward diagnosis and treatment, with the goal of improving comprehensive oral health. The scope of such strategies includes a wide variety of oral health–related issues such as treatment

of dentin hypersensitivity, biofilm elimination, diagnosis and treatment of oral cancers, bone replacement materials, and so on. In the field of endodontics, the development of nanomaterials is focused on steps that would improve antimicrobial efficacy, mechanical integrity of previously diseased dentin matrix, and tissue regeneration. The purpose of this article is to review current status of nanotechnology in restorative dentistry.

In the field of endodontics, the nanomaterials are focused on steps that would improve mechanical integrity, antimicrobial of previously diseased tissue regeneration, and dentin matrix. Currently, it is a new technology tested in endodontics to have challenges over microorganism.

Approaches in Nanotechnology⁶

Two approaches have been followed in production of nanoparticles, namely top down approach and bottom up approach. Top-Down approaches refers to slicing or successive cutting of bulk material to get nano-sized particles. Bottom-up refers to methods where devices 'create themselves' by self-assembly.

The Approaches from Bottom-Up Are:

1)Hypersensitivity cure: Dentine hypersensitivity is a pathological condition mainly caused by changes in pressure transmitted hydrodynamically to pulp. The hypersensitive teeth have dentinal tubules with surface densities that are eight times higher than those of non-sensitive teeth. Dental nanorobots could selectively and precisely occlude selected tubule in a minute thus offering patients a quick and permanent cure. Nanorobotic dentifrices: The nanorobotic dentifrices delivered by mouthwash or toothpaste on subocclusal surfaces could act on supragingival and subgingival area by metabolizing trapped organic matter into harmless and odorless vapors thereby leading to continuous calculus debridement.

2) Dental durability and cosmetics: Tooth durability and appearance may be improved by replacing upper enamel layers with pure sapphire and diamond which can be made more fracture resistance as nanostructure composites, possibly including embedded carbon nanotubes.

Approaches from Top-Down Include:

1)Nanocomposites: Nonagglomerated discrete nanoparticles are homogenously distributed in resins or coatings to produce nanocomposites. The nanofiller used includes an alumino silicate powder having a mean particle size of 80 nm,1:4 ratio of alumina to silica and a refractive index of 1.508. These nanocomposites offer superior hardness, flexural strength, modulus of elasticity and 50% reduction in polymerization shrinkage. Commercially they are available as Filtek O Supreme Universal Restorative Pure Nano O.

2) Nanosolutions: It produces unique and dispersible nanoparticles which can be used in bonding agents. This insures homogeneity and adhesive is perfectly mixed every time. Trade name Adper O single bond plus Adhesive single bond

Advances of nanotechnology

Chitosan Nanoparticle

Chitosan(poly[1,4-b-D-glucopyranosamine]), deacetylated derivative of chitin, is the second most abundant natural biopolymer. Nanoparticles of chitosan could be synthesized or assembled using different methods depending on the end application or the

physical characteristics required in the nanoparticles.⁷ Chitosan has received significant interest in biomedicine because of its versatility in various forms such as powder (micro- and nanoparticles), capsules, films, scaffolds, hydrogels, beads, and bandages. Chitosan has a structure similar to extracellular matrix components and is therefore used to reinforce the collagen constructs. This hydrophilic polymer with a large number of hydroxyl and free amino groups can be subjected to numerous chemical modifications and grafting, resulting in functionalization.^{7,8} Nanoparticles of chitosan have been developed mainly for antibacterial and drug/gene delivery applications. Chitosan has excellent antibacterial, antiviral, and antifungal properties. In case of bacteria, gram-positive bacteria were more susceptible than gram-negative ones. The minimum inhibitory concentrations ranged from 18–5000 ppm depending on the organism, pH, degree of deacetylation (DD), molecular weight, chemical modifications, and presence of lipids and proteins. DD is known to influence the antibacterial activity. With higher DD, the number of amine groups increases per glucosamine unit, and, thus, chitosan

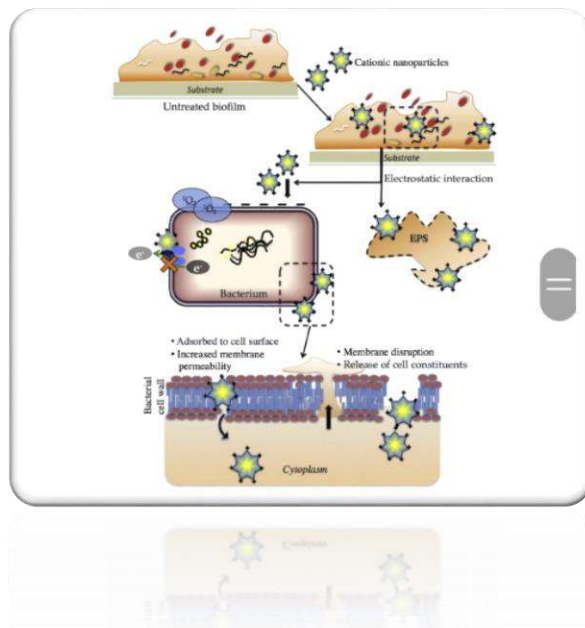
showed higher antibacterial efficacy.^{9,10} Chitosan nanoparticles (CS-NPs) by virtue of their charge and size are expected to possess enhanced antibacterial activity.

Mechanism of Action: The proposed mechanism of action is contact-mediated killing that involves the electrostatic attraction of positively charged chitosan with negatively charged bacterial cell membranes. This might lead to altered cell wall permeability, eventually resulting in the rupture of cells and leakage of the proteinaceous and other intracellular components. In case of fungi, chitosan was hypothesized to enter the cell and reach the nucleus, bind with DNA, and inhibit RNA and protein synthesis.

Current Applications: For the first time, Kishen et al looked into the efficacy of various cationic nanoparticles to improve root canal disinfection. Dentin treated with nanoparticles resulted in significantly reduced adherence of *Enterococcus faecalis*. In another in vitro study, CS-NPs were used in combination with different brands of chlorhexidine to eliminate *E. faecalis* with potential application towards tissue regeneration using

membrane barriers in periapical surgery.

Clinical Significance: Initial studies highlighted that cationic CS-NPs hold significant potential to achieve improved root canal disinfection. However, the prolonged treatment time required to achieve effective bacterial elimination and the effect of tissue inhibitors presented as major setbacks to CS-NPs. This warranted methods to overcome these shortcomings in future research toward the application of CS-NPs.



A schematic diagram showing the antibacterial mechanism of nanoparticles with positive charge (eg, chitosan). Mature bacterial biofilm consisting of abundant extracellular polymeric substance (EPS)

and bacteria enclosed. When cationic nanoparticles are introduced for the treatment of biofilms, it can interact with both EPS and bacterial cells. The initial electrostatic interaction between positively charged nanoparticles and negatively charged bacterial surface. Bacterial killing occurs upon contact-mediated lipid peroxidation via the production of ROS. The membrane damage and increased permeability of unstable membrane eventually lead to ingress of nanoparticles into the cytoplasm and release of cytoplasmic constituents. EPS secreted by bacteria in biofilm may interact with the nanoparticles and prevent them from interacting with bacteria, thus reducing antibacterial efficacy.

Bioactive Glass

Bioactive glass (BAG) received considerable interest mainly because of its osteoinductive effect and antibacterial properties toward various orthopedic and dental applications. BAG consists of SiO_2 , Na_2O , CaO , and P_2O_5 at different concentrations and depends on the local physiological changes for its antibacterial effects¹¹.

Mechanism of Action: The antibacterial activity of BAG depends on the following factors acting simultaneously¹¹.

1. High pH: An increase in pH because of

release of ions in an aqueous environment

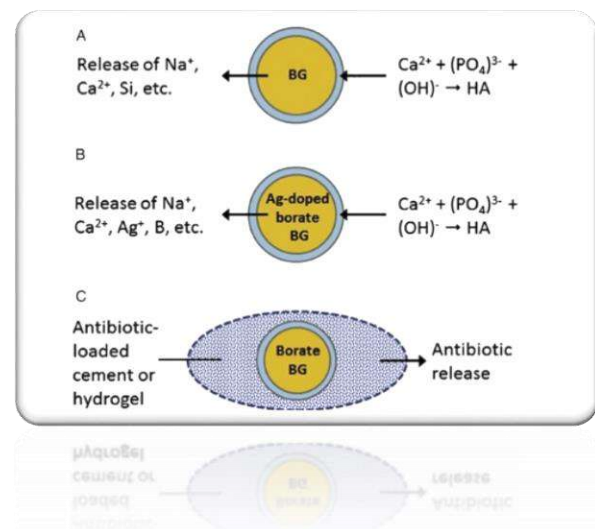
2. Osmotic effects: An increase in osmotic pressure above 1% is inhibitory for many bacteria

3. Ca/P precipitation: Induces mineralization on the bacterial surface. Furthermore, the release of Ca^{2+} , Na^+ , PO_4^{3-} , and Si^{4+} could lead to the formation of bonds with the mineralized hard tissues.

*Current Applications*¹²: BAGs in micro- and nanoforms have been tested to improve root canal disinfection. The nanometric BAG used by Zehnder et al was amorphous in nature, ranging from 20–60nm in size. In vitro root canal disinfection studies showed a significantly less antibacterial effect of BAG compared with calcium hydroxide in preventing residual bacterial growth. Waltimo et al suggested that an ideal preparation of 45S5 BAG suspensions/slurries for root canal disinfection should combine a high pH induction with a capacity for continuing release of alkaline species. Despite the higher specific surface area of nanometric BAG, the micrometric counterpart had a considerably higher alkaline capacity and eliminated biofilms significantly better.

Planktonic bacteria were killed significantly better compared with biofilm bacteria. The reduced antibacterial efficacy of nano-BAG compared with micro-BAG has been mainly contributed to the 10-fold increase in silica release and solution pH elevation by more than 3 units by the latter.

Clinical Significance: The conflicting evidence on BAG microparticles and nanoparticles to generate a significant antibacterial effect warrants further research



(A) One approach has focused on specially formulated BAGs that can dramatically change the local physiological conditions when they are implanted to produce a bactericidal effect. (B) Another approach is to dope the BAG during

its manufacture with trace quantities of elements (eg, Ag) that are known for their antibacterial activity, and, as the glass degrades, those elements are released at a clinically desirable rate. (C) The third approach is to use BAG in conjunction with antibiotics. (Reprinted from Materials Science and Engineering C, volume 41, Rahaman MN, Bal BS, Huang W, Review: emerging developments in the use of bioactive glasses for treating infected prosthetic joints, pages 224–31, Copyright 2014, with permission from Elsevier.)

Silver Nanoparticles

Silver compounds and nanoparticles have been widely used in biomedicine, mainly because of their antibacterial property.^{13,14} In case of dental application, silver and its nanoparticles have been tested for application as dental restorative material, endodontic retrograde filling material, dental implants, and caries inhibitory solution.¹³

Mechanism of Action: Silver is known to produce an antibacterial effect by acting on multiple targets starting from interaction with the sulfhydryl groups of proteins and DNA, alter the hydrogen bonding/respiratory chain, unwind DNA,

and interfere with cell-wall synthesis/cell division. Silver nanoparticles (Ag-NPs) are known to further destabilize the bacterial membrane and increase permeability, leading to leakage of cell constituents.

Current Applications Hiraishi et al¹⁵ tested silver diamine fluoride against *E. faecalis* biofilms in vitro and showed complete elimination of 48-hour biofilms after 60 minutes of interaction; 3.8% silver diamine fluoride was also found deposited on the surface of dentin and penetrated up to 40mm into dentinal tubules. Two main issues associated with Ag-NPs are the potential discoloration of dentin and toxicity toward mammalian cells. Research has been directed toward modifying and developing Ag-NPs with specific antibacterial activity and lower cytotoxicity to host cells.

Clinical Significance Ag-NPs with significant antibacterial activity could be used for root canal disinfection. In addition, toxicity associated with silver ions should not be ignored with careful selection of nontoxic concentration for use in vivo.

Challenges faced by Nanodentistry

Nanotechnology is foreseen to change health care by serving as a novel method for disease diagnosis and prevention, drug delivery and gene therapy. Although nanotechnology appears to introduce ground breaking techniques and devices in the dental field, there are some concerns as well. These include economical nanorobot mass production technique, ethical issues and human safety, biocompatibility issues and the expertise in precise positioning and technique.

Conclusion

Nanotechnology will revolutionize health care, especially dentistry, more profoundly than many other developments of the past. It has the potential to bring out significant benefits, such as improved health. However, as with any other technology, it also carries a potential for misuse and abuse. Nanoparticle-based treatment strategies have the potential to improve antibacterial/antibiofilm efficacy in endodontics. This whole concept of nanoparticles in health care and endodontics should be accepted with positive zeal and caution in future

developments.

References

1. Shrestha A, Kishen A. Antibacterial nanoparticles in endodontics: a review. *Journal of endodontics*. 2016 Oct 1;42(10):1417-26.
2. Cohen ML. Nanotubes, nanoscience, and nanotechnology. *Materials Science and Engineering: C*. 2001 Aug 20;15(1-2):1-1.
3. Thomas JB, Peppas NA, Sato M, Webster TJ. 22 Nanotechnology and Biomaterials.
4. Venugopal J, Prabhakaran MP, Low S, Choon AT, Zhang YZ, Deepika G, Ramakrishna S. Nanotechnology for nanomedicine and delivery of drugs. *Current pharmaceutical design*. 2008 Aug 1;14(22):2184-200.
5. Cushing BL, Kolesnichenko VL, O'Connor CJ. Recent advances in the liquid-phase syntheses of inorganic nanoparticles. *Chemical reviews*. 2004 Sep 8;104(9):3893-946.
6. Sivaramakrishnan SM, Neelakantan P. Nanotechnology in dentistry-what does the future hold in store. *Dentistry*. 2014 Jan

1;4(2):1.

7. Agnihotri SA, Mallikarjuna NN, Aminabhavi TM. Recent advances on chitosan-based micro-and nanoparticles in drug delivery. *Journal of controlled release*. 2004 Nov 5;100(1):5-28.

8. Machida Y, Nagai T, Abe M, Sannan T. Use of chitosan and hydroxypropylchitosan in drug formulations to effect sustained release. *Drug design and delivery*. 1986 Nov 1;1(2):119-30.

9. Tan W, Krishnaraj R, Desai TA. Evaluation of nanostructured composite collagen–chitosan matrices for tissue engineering. *Tissue engineering*. 2001 Apr 1;7(2):203-10.

10. Bonnett R, Krysteva MA, Lalov IG, Artarsky SV. Water disinfection using photosensitizers immobilized on chitosan. *Water research*. 2006 Mar 1;40(6):1269-75.

11. Stoor P, Söderling E, Salonen JJ. Antibacterial effects of a bioactive glass paste on oral microorganisms. *Acta Odontologica Scandinavica*. 1998 Jan 1;56(3):161-5.

12. Zehnder M, Baumgartner G, Marquardt K, Paqué F. Prevention of bacterial leakage

through instrumented root canals by bioactive glass S53P4 and calcium hydroxide suspensions in vitro. *Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology, and Endodontology*. 2007 Mar 1;103(3):423-8.

13. Sondi I, Salopek-Sondi B. Silver nanoparticles as antimicrobial agent: a case study on *E. coli* as a model for Gram-negative bacteria. *Journal of colloid and interface science*. 2004 Jul 1;275(1):177-82.

14. Castellano JJ, Shafii SM, Ko F, Donate G, Wright TE, Mannari RJ, Payne WG, Smith DJ, Robson MC. Comparative evaluation of silver-containing antimicrobial dressings and drugs. *International wound journal*. 2007 Jun;4(2):114-22.

15. Hiraishi N, Yiu CK, King NM, Tagami J, Tay FR. Antimicrobial efficacy of 3.8% silver diamine fluoride and its effect on root dentin. *Journal of endodontics*. 2010 Jun 1;36(6):1026-9.

Case Report

MANAGEMENT OF NON VITAL TEETH WITH INTRINSIC DISCOLORATION USING WALKING BLEACH TECHNIQUE– A CASE REPORT

* Dr. Vidya V, ** Dr. Ramesh Kumar M, *** Dr. Elsy P Simon, , *** Dr. Ravi SV

Abstract

Non-vital bleaching is a non-invasive technique for the treatment of intrinsic discoloration of teeth. Hydrogen peroxide and sodium perborate are the commonly used bleaching agents. The aim of this case report is to demonstrate the non-vital bleaching technique in maxillary anterior teeth. Maxillary central incisors were isolated and root canal treatment was performed. Barrier space preparation was done using a heated instrument. Glass ionomer cement was used as a barrier material. Mixture of hydrogen peroxide and sodium perborate was placed in the canal and sealed with intermediate restorative material. After 1 week, the procedure was repeated to achieve the desired results. Non-vital bleaching is a minimally invasive procedure to restore the esthetics of a discoloured non-vital tooth. However, care should be taken to prevent any post-operative complications.

Keywords: *Non vital bleaching, Discolored tooth, Mechanical barrier*

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Introduction

Trauma and pulpal infections commonly leads to alterations in dental color, compromising patient's esthetics and interaction in social environment. It can be managed through various approaches

depending on various factors like the cause of discoloration, operator experience, patient finances, patient wishes, coronal tooth structure remaining, and previous treatment.¹ The bleaching of non-vital teeth is relatively low risk treatment for

improvement of the esthetics of endodontically treated teeth and was first mentioned by Garretson in 1895, who used chlorine as the bleaching agent. The intra-coronal bleaching procedure is widely used in discolored non vital teeth, because it is efficient, relatively simple, presents low cost and preserves the dental hard tissue compared to the prosthetic treatment. Most commonly used intra-coronal bleaching agents are hydrogen peroxide, carbamide peroxide and sodium perborate.² When these compounds contact with the tooth, they release active metabolites that diffuse in the enamel and dentin and oxidize the pigments, which are responsible for discoloration.³

A well-designed treatment plan is the key for a successful and long-term final outcome. This case report illustrates a successful bleaching treatment in a non-vital maxillary central incisor with intrinsic discoloration.

Case report

A 36-year-old female patient reported to the department of conservative dentistry and Endodontics with a complaint of discolored upper front tooth and desired the discolored tooth to be treated (**Figure**

1). Patient had a history of trauma 10 years back. On intra-oral examination, maxillary right central incisor tooth was structurally intact, firm and with surface discoloration. Tenderness to percussion was negative. Vitality test was performed with cold test using cold spray (Endo- Frost, Coltene, Germany) on all the maxillary anterior teeth which confirmed that #11 was non-vital. Intra oral periapical radiograph with maxillary right central incisor revealed peri-radicular changes with the concerned tooth. Patient was informed about all the restorative options after Endodontics therapy like bleaching, laminates or crown placement. Treatment plan was decided to do a root canal treatment followed by non-vital bleaching of the involved tooth.

Using rubber dam, the tooth to be bleached was isolated and access cavity was made on #11 on the palatal side with a no. 4 round bur. Working length was established with an apex locator (Woodpex V, Germany) and confirmed radiographically. Biomechanical preparation with hand K- file size #35 (Mani Inc, Japan). Abundant amount of normal saline and sodium hypochlorite were used as irrigants during the cleaning

and shaping procedure. Canal was dried with paper points. Obturation was done with cold lateral compaction technique using zycal as sealer(**Figure 2**).

Following root canal filling, the obturated material was removed from the tooth up to 2 mm below the cemento-enamel junction. Stains in the pulp chamber were removed using round bur with the minimal destruction. After removal of the gutta percha and stains, a 2 mm glass ionomer cement (Type 2, 3M Ketac Molar) was placed over the gutta-percha as a barrier material (**Figure 3**). Following this, 30% hydrogen peroxide (nice chemicals Ltd, Kochi) sodium perborate powder was mixed into thick paste and placed immediately in the pulp chamber and dry cotton was tightly placed over this, the access cavity was sealed with temporary restoration. The patient was recalled after 1 week for assessment. At a week visit, tooth 11 showed definite improvement in appearance except near the middle third of the tooth which still showed discoloration. Hence, the bleaching procedure was repeated and the patient was recalled again after 1 week to assess the bleaching results (**Figure 4**). Discoloration was completely

removed and shade of the tooth was enhanced. The hydrogen peroxide – sodium perborate mixture was removed from the pulp chamber using abundant saline and the access cavity was sealed with temporary cement. Patient was recalled after 2 weeks and access cavity was sealed with composite resin restoration. Patient did not experience any post-operative symptoms.



Fig 1 – Pre operative photograph showing discoloration in relation to 11



Fig 2 – Intra oral radiograph after completion of the root canal treatment in relation to 11



Fig 4 – Photograph taken at 2 weeks follow up



Fig 3- Intra oral radiograph showing GIC barrier placed

Discussion

Bleaching of discoloured nonvital teeth was first described during the middle of the 19th century using various chemical agents including chlorinated lime, oxalic acid, acetic acid, chlorine compounds and solutions, sodium peroxide, sodium hypochlorite, different concentrations of hydrogen peroxide, carbamide peroxide and sodium perborate.^{4,5} The mechanism of action of the different bleaching products is the same. The hydrogen peroxide will decompose into oxygen and water. Then,

the oxygen will cause the oxidation and reduction of the organic pigments that are mainly concentrated in the dentin structure. As a result, we obtain the bleaching impact.⁶ Referring to literature, we can use light, heat and even electric currents to activate the bleaching agents and to have a rapid result.⁴ The ‘walking bleach’ technique was described by Spasser in 1961 which involves placing a paste of sodium perborate mixed with water into the pulp chamber of a non-vital tooth and sealing it in. Later, in 1967, Nutting and Poe described a similar technique using a paste of sodium perborate mixed with hydrogen peroxide. Internal tooth bleaching is a minimally invasive, conservative, relatively simple, effective, and low-cost method in the treatment of discolored endodontically treated teeth.

Various risks associated with non-vital teeth bleaching are penetration of hydrogen peroxide in the dentinal tubules, changes in the dentin structure and permeability, general weakening of the physical properties of dental hard tissues, tooth fracture during treatment, over-bleaching, possibility of relapse and the most serious external cervical root resorption. Root resorption is caused by the diffusion of

hydrogen peroxide through the dentinal tubules and micro-perforations of the cement to the cervical periodontal ligaments leading to the destruction of the hard tissues at the level of the cemento-enamel junction, due to local necrosis and inflammation.¹

Glass ionomer cement was used as the barrier material. The shape of the barrier was kept as ‘bobsled tunnel’ as seen from the facial aspect⁷. The significance of this shape is that it blocks all the dentinal tubules which run from pulp chamber to external tooth surface apical to the level of epithelial attachment so that the bleaching agent stays within the cavity and hence helps in the prevention of external root resorption⁵. The average treatment time for single tooth bleaching is 6–8 weeks, although variations may be there. Patients undergoing intracoronary bleaching should be recalled for follow-up on at least a two-week basis to evaluate the response of the single dark tooth, appropriately manage any complications, to reassure and re-motivate the patient, and replace intracoronary bleaching agents if required.

The case presented above highlights the effectiveness of the nonvital bleaching by

walking bleach technique to achieve a successful and predictable cosmetic outcome. Hence, it is concluded that walking bleaching technique can be used as a treatment of choice to bleach the discoloured nonvital endodontically treated cases conservatively as compared to prosthetic procedures.

Conclusion

Case selection and patient compliance was the key to success in this treatment. This case report demonstrates the successful management of a discolored non vital tooth using a mixture of 30% hydrogen peroxide gel (Opalescence Xtra) and sodium perborate as the bleaching material, effectively and safely, by following the precautions to eliminate the side effects of peroxides. No evidence of cervical resorption of the tooth was observed during the follow-up. More advanced studies still needed to gather more information about the stability of results and to detect any adverse effect that could appear. The present case study suggests non vital bleaching therapy to be a successful treatment alternative to the prosthetic treatment.

References

1. A S Coelho L Garrido M Mota Non-Vital Tooth Bleaching Techniques: A Systematic Review. *Coatings*. 2020; 10(1):61
2. C Harshita Effects of Tooth Whitening Agents in Non Vital Teeth. *J Pharm Sci Res* 2014;63:1246
3. N Singh T P Chaturvedi H C Baranwal C K Wang Management of discolored nonvital tooth by walking bleach technique: A conservative approach. *J Int Clin Dent Res Organ* 2020;12:67-71.
4. Nonvital Tooth Bleaching: A Review of the Literature and Clinical Procedures. Gianluca Plotino, Laura Buono, Nicola M. Grande, Cornelis H. Pameijer, Francesco Somma. *JOE* 2008.;34(4)
5. Bleaching discolored devital teeth with using of new agents. Ibrahim Umar, Hakan Kamalak. *IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)* Volume 13, Issue 3 Ver. I. (Mar. 2014), PP 79-82.

6. Preferences on Vital and Nonvital Tooth Bleaching: A Survey Among Dentists from a City of Southern Brazil. Flávio Fernando Demarco, Marcus Cristian Muniz Conde, Caroline Ely, Eliana Nascimento Torre, José Ricardo Souza Costa, María Raquel Fernández, Sandra Beatriz Chaves Tarquinio. *Brazilian Dental Journal* (2013) 24(5): 527-531.
7. Patil AG, Hiremath V, Kumar RS, Sheetal A, Nagaral S. Bleaching of a non-vital anterior tooth to remove the intrinsic discoloration. *J Nat Sci Biol Med*. 2014;5(2):476-479.

Case Report

PARTIAL SUPERFICIAL PAROTIDECTOMY FOR PLEOMORPHIC ADENOMA OF THE PAROTID GLAND – A CASE REPORT

*Dr. Manoj Kumar KP, **Dr. Aswin SK, **Dr. Parvathy R, ***Dr. Vipin Das,

****Dr. Aswathi Vinod

Abstract

Pleomorphic adenoma, otherwise called as benign mixed tumour, is the most common salivary gland tumour which accounts for 70% of all benign salivary gland tumours. Majority of these tumours are found in the parotid glands, with less than 10% in the submandibular, sublingual, and other minor salivary glands. Adenomas mostly originate from the superficial lobe but may occasionally invade the deeper tissues of the gland. This case report depicts a patient with pleomorphic adenoma reported to the Department of Oral and Maxillofacial surgery, KMCT dental college.

The treatment done was extra capsular dissection under GA.

Key words; *Pleomorphic adenoma, Oral and maxillofacial surgery, Parotid dissection*

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Introduction

The most frequently diagnosed benign salivary gland neoplasm was pleomorphic adenoma (70%) followed by Warthin tumor (6.18%). Muco epidermoid carcinoma was the most commonly encountered malignant lesion (56.9%), followed by adenoid cystic Carcinoma.¹ Pleomorphic adenoma ranks the commonly occurring tumor and constitutes up to two-thirds of all salivary gland neoplasms. Pleomorphic adenoma was first termed by Willis. In the earlier years, it was also referred as mixed tumor, enclavoma, branchioma, endothelioma, endochromatoma.² The term “pleomorphic adenoma” is derived due to morphological complexity of the tumor between individuals and glands.^{1,2} Adenomas mostly originate in the superficial lobe but may occasionally invade the deeper tissues of the gland and the parapharyngeal space. Pleomorphic adenoma generally presents as a slowly progressing swelling, asymptomatic, and not involving facial nerve.^{1,2} Ectopic pleomorphic adenoma is a rare presentation in sites other than major and minor salivary

glands. In literature, cases of pleomorphic adenoma in the soft tissue of the neck, skin of the external auditory canal, subcutaneous layer of nose, and lymph node of mediastinum have been reported.³

Case Report

52-year-old male patient reported to the department of Oral and Maxillofacial surgery with a chief complaint of painless swelling in front and below the right ear lobule for last 3 years. The swelling was insidious in onset gradually progressed to the present size. Patient gives a history of tuberculosis 1 year back and was under treatment for the same. A well defined swelling of size 8 x 7 x 7 cm present on the right side below the ear. It extends superoinferiorly from right ear lobule to thyroid cartilage and anteroposteriorly from anterior border of masseter to posterior border of sternocleidomastoid. It was not adherent to any underlying structures, no visible scars or sinus seen. There was no visible pulsation over the swelling and no localised rise in temperature. No signs of



facial nerve involvement, contralateral parotid gland appeared normal.

Provisionally the lesion was diagnosed as pleomorphic adenoma.

FNAC and MRI was performed. FNAC suggestive of benign neoplasm of parotid gland. MRI shows well circumscribed lobulated heterogenous mass of size 8 x 7x 7 cm involving middle and inferior portion of superficial lobe of parotid gland. Lesion is encapsulated with no evidence of infiltration to the surrounding structures. The final diagnosis was pleomorphic adenoma.

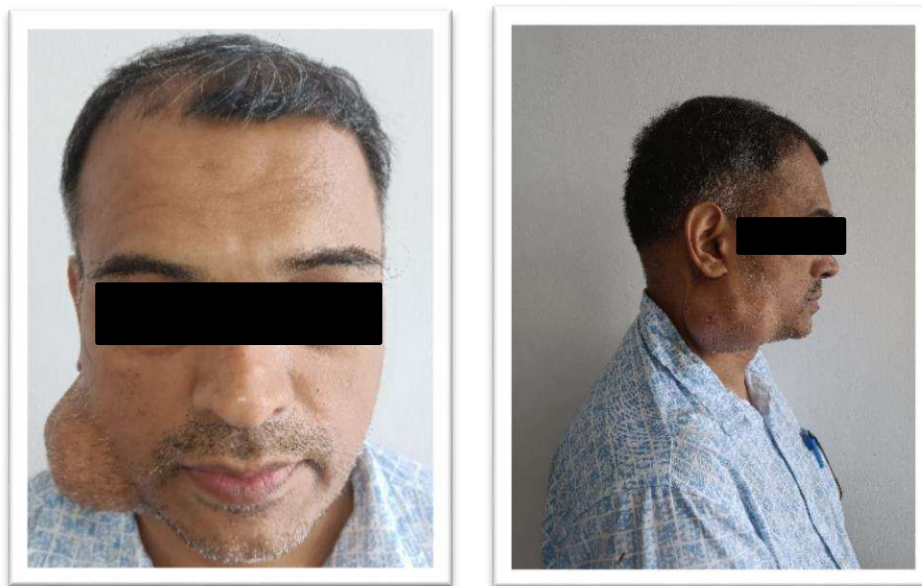


Figure 1 & 2- Preoperative photographs

Surgical technique

Under orotracheal intubation GA administered. LA administered to the local site. Modified BLAIR'S incision placed. Blunt dissection in subcutaneous level was performed, exposing the parotidomasseteric fascia covering the capsule. Parotid mass was dissected from the superficial parotid lobe .Hemostasis attained .Thorough wound debridement done . ROMOVAC suction drain was placed. Wound closure done by layer by layer using(2-0) vicryl and (5-0) ethilon. Patient extubated uneventfully and the postoperative period was uneventful

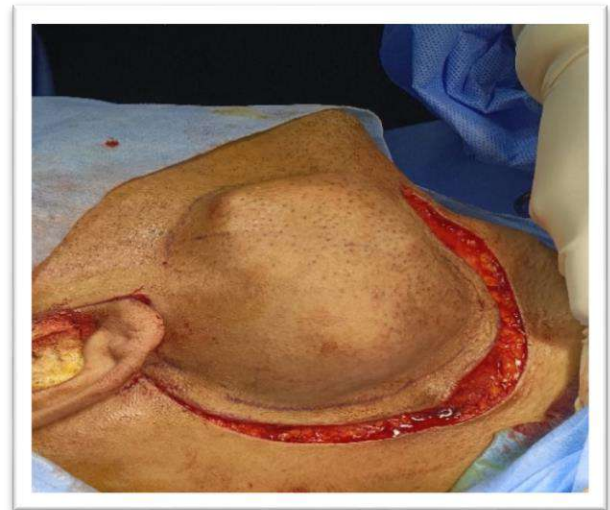


Figure 4: Modified Blair's incision placed



Figure 3- Skin marking for incision

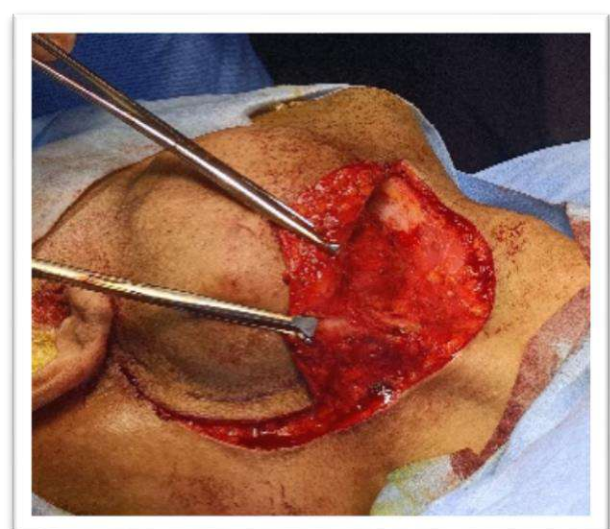


Figure 5: Elevation of flap

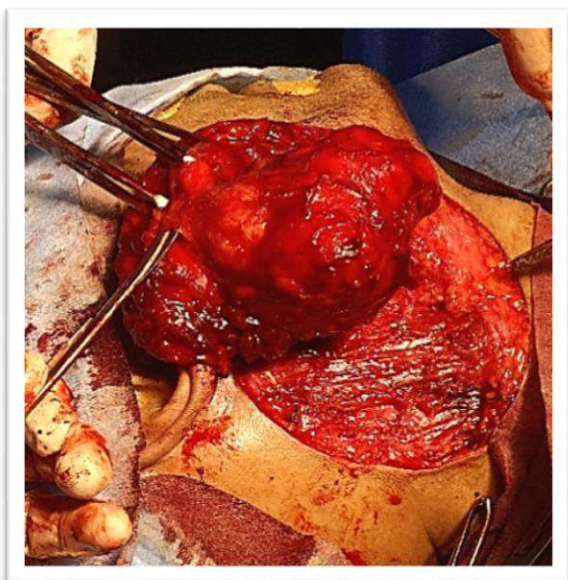


Figure 6: Exposing the parotid mass

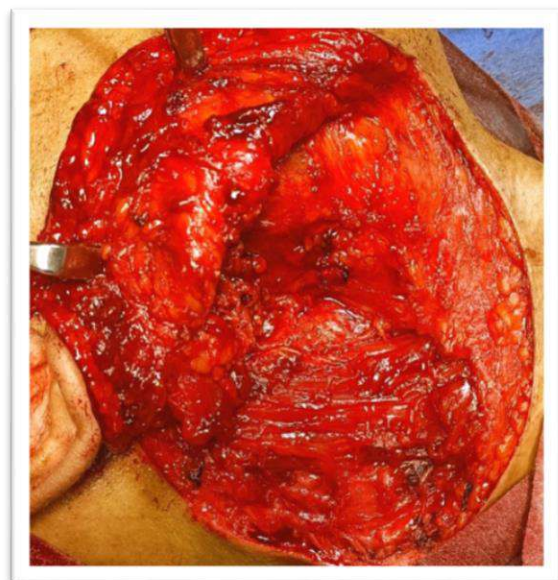


Figure 8: After excision of parotid mass

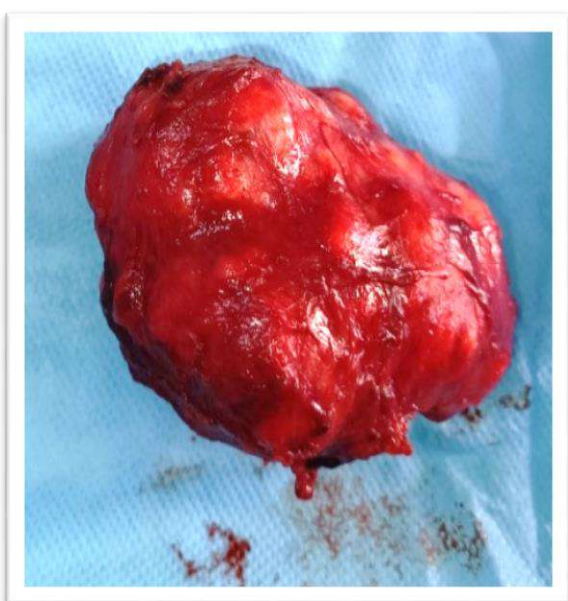


Figure 7: Excised parotid mass



Figure 9: Wound closure and drain placement



Figure 10: Post operative after 3 weeks

Discussion

Pleomorphic adenoma can be found among all ages (kids or adults). It shows about 45% to 75% of neoplasm in salivary gland and the incidence of 2-35 cases per 100,000 people. The comparison between woman and man are 2:1. This tumour usually found in the ages of thirties till sixties with the average of 43-46 years old.¹ The tumor usually presents as a slow growing, painless, firm nodular mass. Isolated

nodules are generally outgrowths of the main nodule rather than a multinodular presentation². The main characteristics are the high recurrence rate and not infrequent malignant conversion. Symptoms are usually rare or not significant; in fact in most cases, the only sign is asymptomatic swelling, that slowly grows in the parotid region without involving the facial nerve, the function of which remains unchanged.^{2,3}



Pleomorphic adenomas are generally discovered during routine physical examination, as an asymptomatic mass. The majority of these tumors measure 2–6 cm in size when excised. However large tumor may be seen as a single, irregular nodular mass stretching the overlying skin or mucosa. The tumor may weigh from several grams to more than 8 kilograms⁴. Pleomorphic adenoma exhibits a great histological diversity, such as differentiation into oncocytic, sebaceous, mucinous, squamous, chondroid, osseous or adipose cells. Squamous metaplasia rarely results in the formation of extensive keratin-filled cyst lined by squamous epithelium. Extensive squamous metaplasia can be mistaken for malignancy, including mucoepidermoid carcinoma and squamous cell carcinoma^{5,6}. In the minor salivary gland, it is more common in the palate. Tumors of the minor salivary glands are uncommon, with the most common

intraoral site reported being the hard and soft palate owing to the preponderance of minor salivary glands in this region followed by the lips⁷. It is generally considered to be a benign tumour, even if this lesion presents several histological features due to the different compounds with a mixoid or condroid matrix. In an attempt to explain the histogenesis of salivary gland tumors, a bicellular theory of origin has been presented. This theory is supported by indirect evidence from light and electron microscopy. Two cells, the excretory duct reserve cell and the intercalated duct reserve cell, are presented as the hypothetical cells of origin for salivary gland neoplasms⁸. Pleomorphic adenoma is a benign salivary gland neoplasm which arises by neoplastic proliferation of parenchymatous glandular cells along with myoepithelial components, which may sometimes possess malignant potentiality^{9,10,11}.

Conclusion

Pleomorphic adenomas are benign salivary gland neoplasms that can grow in to extensive sizes if left untreated, hence need to be diagnosed at the earliest. The treatment is surgical and there are two main different approaches : enucleation (local dissection) or so called subtotal superficial parotidectomy and lateral or total parotidectomy. Histopathological characteristics of pleomorphic adenomas especially of capsular alterations such as thin capsule areas, capsule free regions, capsule penetration, satellite nodules and pseudopodia in the different subtypes are important for the choice of surgical treatment and first explanation for tumor recurrence.

References:

1. Farhat F, Asmir RA, Yudhista A, et al. An uncommon occurrence of pleomorphic adenoma in the submandibular salivary gland: a case report. *Open Access Maced J Med Sci*. 2018;6(6):1101–1103. doi: 10.3889/oamjms.2018.248.
2. Luna MA. Salivary glands. In: Pilch BZ., editor. *Head and neck surgical pathology*. Philadelphia: Lippincott Williams and Wilkins; 2001. pp. 284–349.
3. Sergi B, Limongelli A, Scarano E, et al. Giant deep lobe parotid gland pleomorphic adenoma involving the parapharyngeal space. report of three cases and review of the diagnostic and therapeutic approaches. *Acta Otorhinolaryngol Ital*. 2008;28(5):261–265
4. Vincente OP, Marques NA, Aytes LB, et al. Minor salivary gland tumors: a clinicopathological study of 18 cases. *Med Oral Patol Oral Cir Buccal*. 2008;13(9):582–588.
5. Zarbo RJ. Salivary gland neoplasia: a review for the practicing pathologist. *Modern Pathology*. 2002;15(3):298–323. doi: 10.1038/modpathol.3880525. DOI:

6. Tandon A, Jaiswal R, Siddiqui S, et al. Keratinizing pleomorphic adenoma: an unusual case report. *J Oral Maxillofac Pathol.* 2018;22(Suppl 1):69–72.

doi: 10.4103/jomfp.JOMFP_200_17.

7. Taiwo AO, Akinshipo A, Braimah RO, et al. Pleomorphic adenoma of the upper lip: a case report. *Saudi J Med Sci.* 2018;6(1):32–35.

doi: 10.4103/sjmms.sjmms_109_16.

8. Regezi JA, Batsakis JG. Histogenesis of salivary gland neoplasms. *Otolaryngol Clin North Am.* 1977;10(2):297–307

9. Califano J, Eisele DW. Benign salivary gland neoplasms. *Otolaryngol Clin North Am.* 1999;32(5):861–873.

doi: 10.1016/S0030-6665(05)70178-

X. DOI:

10. Morphological pattern of salivary gland tumours. Gill MS, Muzaffar S, Soomro IN, Kayani N, Hussainy AS, Pervez S, Hasan SH. *J Pak Med Assoc.* 2001 Oct;51(10):343-

6.PMID: 11768933

11. Rajendran S, Sivapathasundaram S. *Shafer's Textbook of Oral Pathology.* 6th ed., New Delhi: Elsevier; 2009. pp. 219–224.