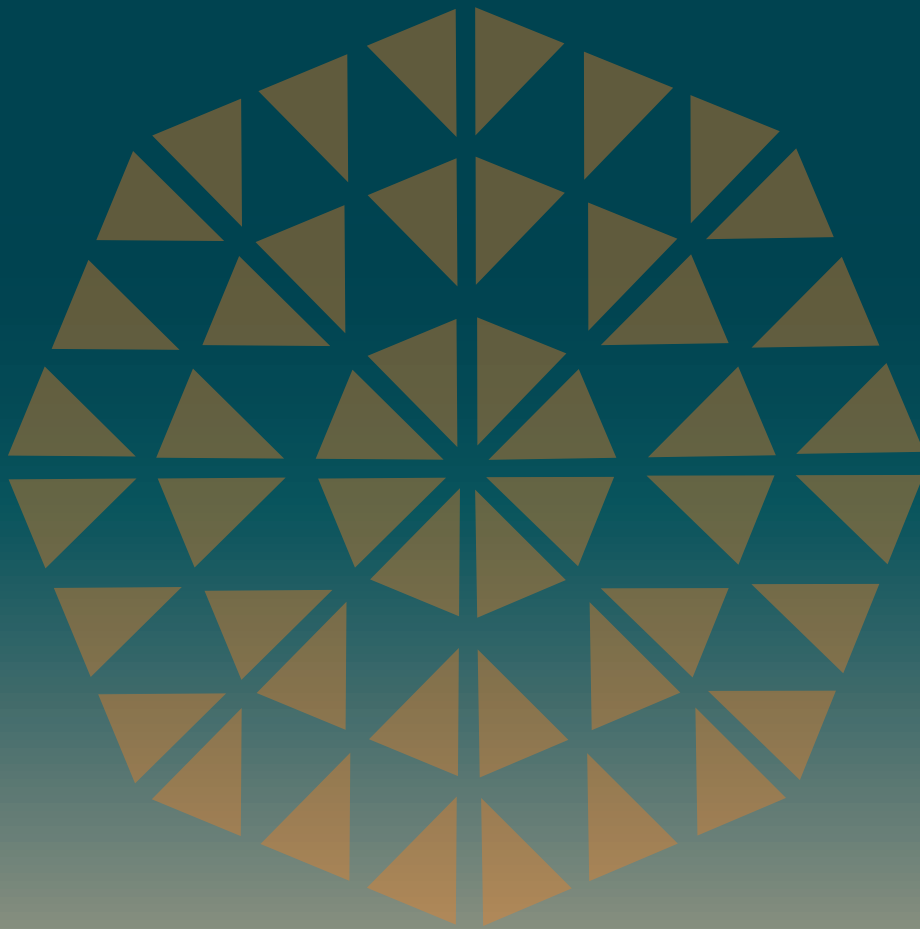


DENTAL BITES

Volume 9 Issue 3 | July - September 2022

Orthodontic and Orthognathic



a quarterly publication of



KMCT
DENTAL COLLEGE
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a quarterly publication of



KMCT Medical College Campus, Mukkam, Kozhikode – 673602

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How to become a good professional.....

All of us are born to serve the society. Today, we frequently see the headline that doctors are being beaten by public.... what may be the reason for it have you ever thought about this subject??? Lack of professionalism and dedication to work is the prime cause of this. We have reached this position with so much of dedication, hardwork, perseverance and good attitude towards our patients. We gain all these qualities through these many years of experience and more than everything dedication to what we do is the most important of everything. I would like to tell you the importance of professionalism through this editorial.

Professionalism is a good quality to possess to succeed in the workplace. Professionals develop and practice several characteristics and qualities that help them make a positive impression. Learning how to be a professional can help you progress along your career path.

Being a professional means, you conduct yourself in a way that shows your work ethic and makes a positive impression on others. Professionals have a set of qualities and characteristics, like dependability and respect, that help them succeed in their roles and inspire others to do the same. Other characteristics that could contribute to being a professional include dressing appropriately for the workplace, helping teammates with tasks.

Professionalism is a sign of responsibility, dependability and loyalty. It can help you better connect with co-workers, allowing you to achieve higher-quality results. Having a professional attitude means you're usually more empathetic towards team members, which can help tell when they might need assistance. Practicing professionalism also helps you to be more proactive. You're more likely to keep certain habits that allow you to identify potential challenges well before they happen and find ways to overcome or avoid them.

All our dreams can come true if we have the courage to pursue them. Good things come to people who wait, but better things come to those who go out and get them. Success is walking from failure to failure with no loss of enthusiasm.

Dr Manoj Kumar KP

Editor

TABLE OF CONTENTS

1. Effectiveness of triple antibiotic paste in lesion sterilisation and tissue repair of primary teeth: A pilot study – Original Research pg 6
*Dr.Amith Adyanthaya , Dr.Gopika Gopan, Dr.Aparna Sivaraman ,
Dr.Mubeena.T.A, Dr.Preema.M.U*

2. Photobiomodulation in Orthodontics – Literature Review. pg 14
*Dr Binu Purushothaman, Dr Fawaz Varik, Dr Amrita Ashok,
Dr Bavitha T.K.*

3. Stem cells in orthodontics and Dentofacial Orthopaedics - Review pg 22
*Dr Makal Madhav, Dr Amrita Ashok, Dr Jibin K. Sabu, Dr Sajai
Bharath, Dr Safir N.K.*

4. Orthognathic Surgery using virtual surgical Planning- Case report pg 29
*Dr Anahita Ann Koruth, Dr Aswin S K, Dr Deepthi Krishnan Kutty,
DrAnroop A, Dr Manoj Kumar K P.*

5. Orthodontic bone screws – Review pg 35
*Dr Fawaz Varik, Dr Amrita Ashok, Dr Makal Madhav, Dr Safir
N.K.*

Original Study

EFFECTIVENESS OF TRIPLE ANTIBIOTIC PASTE IN LESION STERILISATION AND TISSUE REPAIR OF PRIMARY TEETH: A PILOT STUDY

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

Abstract

Background: Root canals of primary teeth at the stage of root resorption, cannot always be biomechanically prepared and obturated by the conventional endodontic treatment. Anxiety, fear, lack of cooperation in young children makes the conventional endodontic procedure a tough challenge. The concept of lesion sterilization and tissue repair (LSTR) therapy employed a mixture of antibacterial drugs for disinfection. Repair of damaged tissues can be expected if lesions are disinfected.

Aim: To assess the clinical and radiographic success of triple antibiotic paste in the treatment of necrosed primary molars.

Materials and Methods: 15 necrotic primary molars were selected randomly. Triple antibiotic paste containing medicaments ciprofloxacin , minocycline and metronidazole mixed with propylene glycol were used to fill the medication cavities which was restored with zinc oxide temporary restoration which was then followed by glass ionomer restoration. Clinical and radiographic evaluation was done at 3 and 6 months.

Results: Clinical and radiologic examination during follow up periods revealed overall clinical success of 93% and radiographic success of 87% by the use of triple antibiotic medicament for lesion sterilization and tissue repair.

Conclusion: Lesion sterilization and tissue repair with triple antibiotic paste shows good clinical as well as radiographic success in the treatment of primary teeth with necrotic pulp

Key words: Triple antibiotic paste, primary teeth, LSTR, necrotic teeth

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Introduction

The primary goal of endodontic treatment in primary teeth is to eliminate infection, and to retain the tooth in a functional state until their normal exfoliation time without endangering the permanent dentition or the general health of the child.¹ An intact tooth successfully disinfected and with a restored clinical crown is a superior space maintainer than an appliance.² Early loss of primary teeth can cause problems such as space loss, ectopic eruption, disturbance in eruption sequence, development of aberrant habits such as tongue thrusting, mouth breathing, altered phonation, and impairment of function.³ Thus, it is important that primary dentition be maintained in the dental arch, in its functional form, for proper dental, skeletal, and psychologic development of child.⁴ To accomplish this, many treatment procedures have been proposed such as indirect pulp capping, direct pulp capping, partial pulpotomy, pulpotomy, and pulpectomy.^{5,6}

In recent years, the Cariology Research Unit of Niigata University School of Dentistry has developed the concept of lesion sterilization and tissue repair (LSTR) therapy that employed a mixture of antibacterial drugs for disinfection. Repair of damaged tissues can be expected if lesions are disinfected.²

The infection of the root canal system is considered to be a polymicrobial infection, consisting of both aerobic and anaerobic bacteria. Because of complexity of the root canal infection, it is unlikely that any single antibiotic could result in an effective sterilization of the canal. More likely, a combination would be needed to address the diverse flora encountered. The combination that appears to be promising consists of metronidazole, ciprofloxacin, and minocycline. Alone, none of these drugs resulted in complete elimination of the bacteria. However, in combination, these drugs were able to consistently sterilize all samples⁷

Methodology

This cross sectional study was conducted in the Department of Pediatric and Preventive Dentistry, KMCT Dental college, Calicut.

INCLUSION CRITERIA

- Primary necrotic molar
- Presence of furcal abscess
- Grade 1 mobility
- Tooth with resorption not more than half the root length
- Radiolucency in furcal area

EXCLUSION CRITERIA

- Medically compromised subjects
- Children allergic to antibiotics
- Teeth nearing exfoliation
- Grade 2 mobility
- Teeth with perforated pulpal floor

After the initial screening, 15 primary molars of healthy children and satisfying the inclusion and exclusion criteria, aged between 4 and 8 years were selected, from the outpatient department. Procedure was carried out after obtaining consent from parents.

Preparation of the antibiotic combination

The chemotherapeutic agents used were metronidazole, ciprofloxacin, minocycline. The drugs were pulverized into fine powder using sterile porcelain mortar and pestle and stored in glass containers separately to prevent exposure to sunlight and moisture. The antibiotic combination were freshly prepared for each use. Propylene glycol was the vehicle used to form the paste of required consistency.

For preparing the triple antibiotic paste, the chemotherapeutic were combined in the same ratio and the paste was made by mixing it with propylene glycol.



Fig 1: Preparation of antibiotic paste

Placement of the antibiotic paste:

Cavity was prepared according to the extent of the lesion, making sure no overhanging tooth structure was left, in order to provide

an access to the pulp chamber. Access opening was done with a round bur and roof of the pulp chamber was removed followed by extirpation of coronal necrotic pulp, under copious irrigation with normal saline and drying with cotton pellets to ensure visualization of the canal orifices. The canal orifices were enlarged using a round bur to receive medicament. Following this, the cavities were cleaned and irrigated with normal saline and dried using cotton pellets. The antibiotic paste was placed into medication cavity. After the placement of antibiotic paste, cavity was filled with zinc oxide eugenol cement. Patients were recalled after 10 days permanent restoration was given when the tooth is asymptomatic.



Fig 2: Placement of the antibiotic paste

Outcome measures

The clinical success was evaluated on the basis of absence of pain, recurrent abscess, sinus/fistula and radiographic success was determined by continuity of lamina dura,

absence of bone resorption and internal resorption

Results

3 MONTH POSTOPERATIVE CLINICAL AND RADIOGRAPHICAL EVALUATION

All teeth remained asymptomatic

6 MONTH POSTOPERATIVE CLINICAL AND RADIOGRAPHICAL EVALUATION

Clinically 1 teeth exhibited pain and tenderness and radiographically 2 teeth exhibited discontinuity in lamina dura bone loss and internal resorption

Table 1: Pain

	No n(%)	Yes n(%)
Baseline	4(26.7)	11(73.3)
3 months	15(100)	
6 months	14(93.3)	1(6.7)

Table 2: mobility

	No n(%)	Yes n(%)
Baseline	9(60)	6(40)
3 months	15(100)	-
6 months	15(100)	-

Table 3: Abscess

	No n(%)	Yes n(%)
Baseline	2(13.3)	8(6.7)
3 months	15(100)	-
6 months	15(100)	-

Table 6: internal resorption

	No n(%)	Yes n(%)
Baseline	13(86.7)	2(13.3)
3 months	13(86.7)	2(13.3)
6 months	13(86.7)	2(13.3)

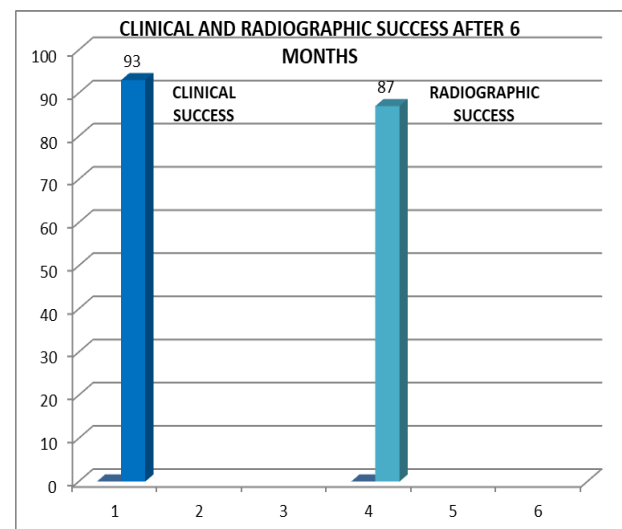
Table 4: discontinuity of lamina dura

	No n(%)	Yes n(%)
Baseline	15(100)	-
3 months	15(100)	-
6 months	13(86.7)	2(13.3)

Table 5: bone resorption

	No n(%)	Yes n(%)
Baseline	7(46.7)	8(53.3)
3 months	7(46.7)	8(53.3)
6 months	13(86.7)	2(13.3)

Clinical and radiologic examination during follow up periods revealed overall clinical success of 93% and radiographic success of 87% by the use of triple antibiotic medicament for lesion sterilization and tissue repair



Representative intraoral radiographs



Fig a

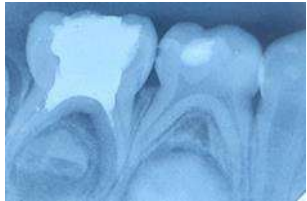


Fig b

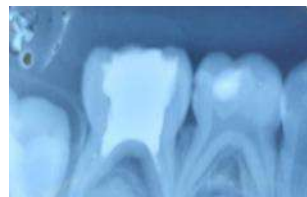


Fig c

Fig a) preoperative radiograph of 85 b) 3 month follow up c) 6 month follow up



Fig d



Fig e



Fig f

Fig d) preoperative of 75 e) 3 month follow up f) 6 month follow up

Discussion

Pulp therapy in primary teeth remained controversial for numerous reasons. The perceived difficulty of behaviour management in pediatric population, differences in morphology of primary and permanent teeth, desired timely resorption of primary teeth, and difficulties with root canal filling materials have added to the reluctance among dentists to carry out the procedure⁴.

Zinc oxide eugenol was the first root canal filling material to be recommended for primary teeth as described by Sweet in 1930. However, according to several studies, there are many reports about the slow rate of resorption of zinc oxide eugenol cement, when forced beyond the apex, there is risk of deflection of erupting succedaneous teeth because of its hardness and also with limited antibacterial action⁸.

The present therapy apparently depends on elimination of bacteria from root canal system but not on mechanical procedures. Therefore the clinical procedure is simple and does not require long chair-time or multiple visits. This treatment has been

designated as non-instrumentation endodontic treatment (NIET)².

Excellent clinical results of LSTR in the treatment of infected primary teeth may be ascribed by the bactericidal efficacy of the mixture of drugs. Previous studies have clearly demonstrated that triple antibiotic paste is capable of eliminating bacteria from infected dental tissues in both primary and permanent teeth⁹.

Since the overwhelming majority of bacteria in the deep layers of infected dentin of root canal wall consist of obligate anaerobes, metronidazole was selected as first choice among antibacterial drugs. Metronidazole even at high concentration cannot kill all the bacteria, indicating the necessity of combining it with other drugs. Thus, ciprofloxacin and minocycline were combined with metronidazole to sterilize infected root dentin¹⁰.

It was also demonstrated insitu that the drug mixture could be carried quickly and efficiently by propylene glycol and thus penetrated into the endodontic lesions of primary teeth and killed all the cultivable bacteria within 1 day, indicating that the lesions can be sterilized by topical application of triple antibiotic paste⁷.

The exact reaction of these drugs in the pulp is not known. Hence, some of the histologic studies revealing the effects of these medicaments on the pulp tissue are required.

Hence, within the limitations of the study, the primary teeth with the peri radicular lesions, including those at various stages of physiological root resorption, can be conserved by the LSTR therapy.

Conclusion

Lesion sterilization and tissue repair with triple antibiotic paste shows good clinical as well as radiographic success in the treatment of primary teeth with necrotic pulp. However, we advocate further clinical and histological studies with longer follow-up till the period of tooth exfoliation to ascertain the efficacy of this novel treatment modality.

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Review

PHOTOBIOMODULATION IN ORTHODONTICS

*Dr Binu Purushothaman,** Dr Fawaz Varik,***Dr Amrita Ashok,** Dr Bavitha T.K.

Abstract

Photobiomodulation, also known as low-level light therapy (LLLT), employs near-infrared light (600-1000nm) from a low-level laser or light-emitting diode. It is also known as *Low level Lasers; Cold Lasers; Therapeutic Lasers, and Soft Lasers*. This review article explains the mode of action of photobiomodulation and its application in orthodontics.

Key words; *Photobiomodulation (PBM), low-level laser therapy, low-level light therapy, light emitting diode, orthodontic tooth acceleration, orthodontic pain*

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Introduction

Orthodontic treatment requires an average of 18 to 24 months of therapy. Several authors agree that these long treatment times, together with dental pain, are the main concerns for patients who undergo the treatment and are among the most important reasons causing them not to undertake it or to interrupt it¹. In light of these considerations, it was necessary to find a method that reduces the duration of orthodontic treatment but at the same time, was not invasive, was free of side effects,

was simple to use, and that can become part of the orthodontist's therapeutic tools.

To date, surgical, pharmacological, and physical approaches are the methods proposed the most often in the literature for increasing dental movements, and although they have shown positive results, some disadvantages prevent them from being applied in routine clinical practice². Pharmacological therapy with cytokine, Parathormone PTH, vitamin D, and RANKL/RANK/OPG show promising results, while on the other hand, relaxin

reveals disadvantages, not by accelerating dental movement, but by increasing tooth mobility.

In contrast, surgical approaches (piezocision) have the most predictable outcomes but with limited application due to their aggressiveness. The disadvantage of

these surgical techniques, in addition to the invasiveness, is that the acceleration only occurs in the first 3 to 4 months and it declines with time to the same level as the controls³.

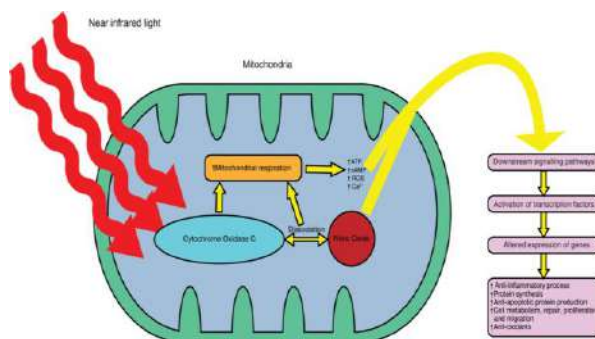
Methods to accelerate tooth movement

PHARMACOLOGICAL METHODS	PHYSICAL & MECHANICAL STIMULATION METHODS	SURGICAL METHODS
PROSTAGLANDINS ⁴	RESONANCE VIBRATION	CORTICOTOMY
CORTICOSTEROIDS	ELECTROMAGNETIC STIMULATION	OSTEOTOMY
PARATHORMONE	DIRECT ELECTRIC CURRENT	DISTRACTION OF PERIODONTAL LIGAMENT
VITAMIN D ⁵		DENTO ALVEOLAR DISTRACTION
OSTEOCALCIN		MICRO OSTEO PERFORATION
NITRIC OXIDE		PIEZOCISION
PLATELET RICH PLASMA & FIBRIN ⁶		

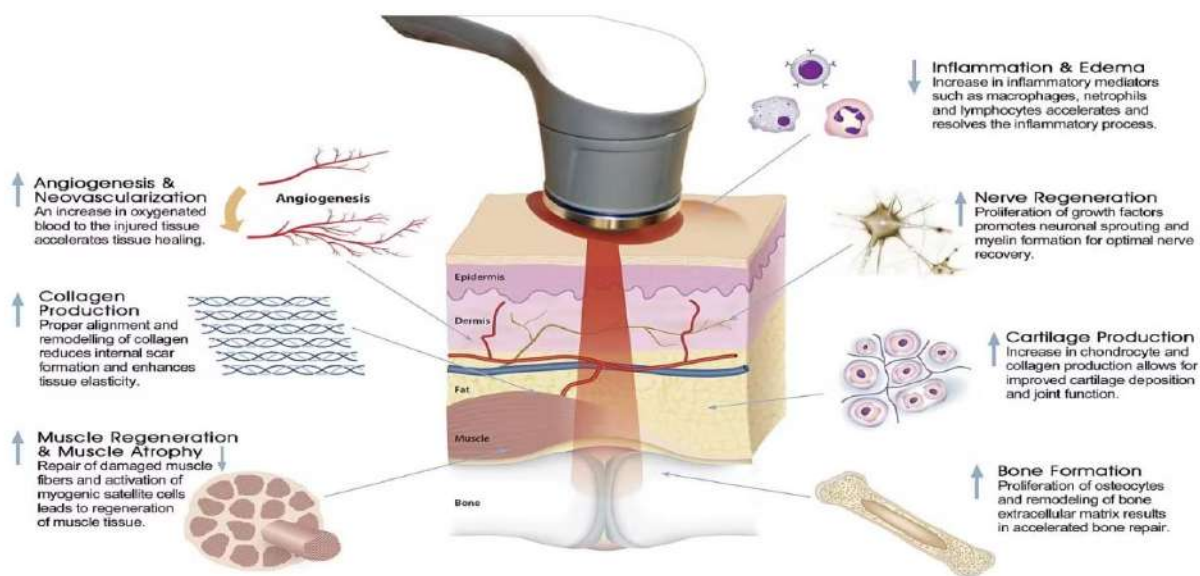
Photobiomodulation

Photobiomodulation therapy (PBMT) uses a low-intensity laser such that its photon energy reaches the cell nucleus and increases the synthesis of deoxyribonucleic acid (DNA) and ribonucleic acid (RNA) and the consequent protein synthesis⁷.

Mode of action



This effect facilitates tissue repair and bone remodeling by raising metabolic activity in damaged areas. LAO may also be functioning through an increased vascular activity, which would also contribute to the rapid turnover of the bone and is amenable to light. In addition, there is some evidence that PBM therapy can reduce pain because of its anti-inflammatory properties. Clinical studies investigating orthodontic treatment with fixed appliances and clear aligners have found significantly increased tooth movement in the irradiated patients. An evaluation of 18 clinical trials found evidence supporting the efficacy of laser therapy and PBMT⁸.



Application in orthodontics

Photobiomodulation (PBM) lasers are devices that use coherent, collimated, monochromatic light energy (the three defining qualities of lasers) to perform therapeutic procedures. They use photons (light energy) to modulate biological processes. PBM lasers are unable to perform any surgical procedures. They are non-surgical and are used primarily for pain management/palliative treatments. Only recently have they shown the ability to affect tooth movement and bone growth, a critically important facet of orthodontic therapy⁹. Following are the applications of PBM in Orthodontics.

1) To Control Pain during Orthodontic Therapy

A recent (March 2020) National Library of Medicine/NIH literature search (pub med) using the terms “low level lasers and pain control” resulted in 279 papers that discuss the use of this modality for everything from pain reduction post cesarean section to post-herpetic neuralgia to fibromyalgia to nipple pain during breastfeeding to carpal tunnel syndrome, and much more.

One of the most comprehensive textbooks on the subject, by Tuner and Hode lists a large number of procedures for which PBM lasers are indicated in dentistry. These procedures include: alveolitis, anaesthesia, pericorinitis, hypersensitive dentin, mucositis, and TMJ disorders.

Nobrega performed a placebo controlled randomized double-blind study that showed that PBMT was effective in reducing the pain from separators placed on first molars. Dominguez and Velasquez showed PBMT to be effective in reducing pain during the final stage of arch wire placement with several different bracket systems. They used an 830 nm diode laser at a power of 0.1 W with a dose of 80 J/cm² placed buccally and lingually in one arch while the opposing arch was used as control.

Bicakci et al. showed significant reductions in both pain levels and PGE₂ levels when PBM lasers were used to reduce orthodontic post-adjustment pain. The laser used was 820 nm wavelength, 50 mW, at 4 points surrounding the first molar while the molar on the contralateral side acted as a control. Maximum effect was

reported at 24 h post activation of the arch wires.

De Sousa et al. concluded that PBMT had demonstrated efficacy in reducing orthodontic pain. In their discussion of pain control they attribute two different mechanisms: increased production of Bendorphin, and repression of the conduction of nerve impulses in peripheral nerve ends, impairing transmission of the local pain impulses. The most effective parameters were 28 Joules per tooth applied 15 days per month.

2.To Accelerate Tooth Movement

Gomes published a study on rats that evaluated the effects of PBMT on periodontal tissues and alveolar bone remodelling. He concluded that the PBMT strongly stimulated alveolar bone remodelling and favoured continuous reorganization of the soft periodontal tissues, leading to the maintenance and integrity of the periodontal microstructure under orthodontic force.

Varella investigated the effects of PBMT on interleukin 1-B levels in gingival crevicular fluid and its correlation with orthodontic tooth movement. They concluded that PBMT accelerated

orthodontic tooth movement and increased the levels of interleukin 1-B in crevicular fluid.

3.For Rapid Palatal Expansion

Fazilat et al. split and expanded rabbit mandibles and studied the effect of PBMT on the speed of bone healing. The greatest change in the amount of bone healing when compared to control mandibles was found at day 10 of the study.

Occlusal radiographs were digitized and submitted to imaging software to measure optical density of the area. Results showed a statistically significant increase in bone density and accelerated healing of the midpalatal area.

4.To Control Gag during Impression Making

Elbay studied whether PBMT could prevent gagging in children undergoing intraoral maxillary radiography. Patients unable to tolerate the control radiograph were able to tolerate the procedure after PBMT. Hence this technique can also be used while taking impressions of those who are more prone to gag while doing it.

5. In Palliation of Recurrent Aphthous Ulcers and Other Gingival Irritations That Occur During Orthodontic Treatment.

Pinheiro gathered 165 patients with various maxillofacial disorders, including TMJ pain, trigeminal neuralgia, aphthous ulcers, and other disorders. They were all treated with PBMT. Their results revealed

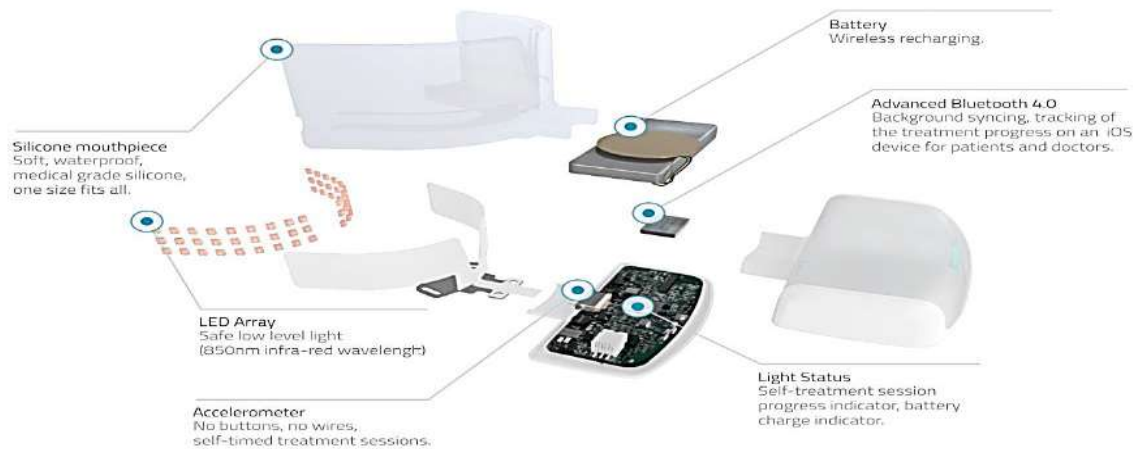
that of the 165 patients, 120 were asymptomatic at the end of treatment, 20 improved considerably, and only 20 were symptomatic.

Devices used

1. Smart Device

2. Light-emitting Diode (LED)–mediated Photobiomodulation¹⁰

Smart Device



Light-emitting Diode (LED)–mediated Photobiomodulation

850 nm wavelength, 60 mW/cm² power, continuous LED with OrthoPulse device (Biolum Research Ltd, Vancouver, British Columbia, Canada)

Conclusion

The low-energy-density laser with the parameters set, was found to be an efficient instrument for accelerating tooth

movement. From an analysis of the literature, the action mechanisms of PBMT on the orthodontic movement are not entirely clear. Therefore, more experiments are needed to differentiate the optimal energy, wavelength, and duration for usage. A chemical analysis of the gingival crevicular fluid (GCF) for the detection of chemical mediators could be a technique that can be used to better clarify the bio-molecular aspects related to the application of PBMT.

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Review

STEM CELLS IN ORTHODONTICS AND DENTOFACIAL ORTHOPAEDICS

*Dr Makal Madhav, **Dr Amrita Ashok, *Dr Jibin K. Sabu, ** Dr Sajai Bharath,

*Dr Safir N.K.

Abstract

For craniofacial anomalies, SCs have been applied to regenerate hard tissue (such as treatment of alveolar cleft) and soft tissue (such as treatment of hemifacial macrosomia). Several attempts have been done to reconstruct impaired temporomandibular joint. Also, SCs with or without bone scaffolds and growth factors have been used to regenerate bone following distraction osteogenesis of mandibular bone or maxillary expansion. Current evidence shows that SCs also have potential to be used to regenerate infrabony alveolar defects and move the teeth into regenerated areas. Future application of SCs in orthodontics could involve accelerating tooth movement, regenerating resorbed roots and expanding tooth movement limitations. However, evidence supporting these roles is weak and further studies are required to evaluate the possibility of these ideas. In this review current and future applications of stem cells (SCs) in orthodontics and dentofacial orthopedics have been discussed.¹

Key words; Alveolar bone grafting, Dentofacial deformities, Distraction osteogenesis, Orthodontic tooth movement, Root resorption, Stem cells

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Introduction

The term “stem cell” has roots as far back as 1868 in the works of German biologist Haeckel. Wilson coined the term stem cell. Russian Histologist Alexander Maksimov proposed the term Stem cell in 1908.² Gronthos et al. identified odontogenic progenitor population in adult dental pulp in 2000. Human exfoliated deciduous teeth (SHEDS) were discovered by Dr. Songtao Shi in 2003³. Dr. Kerkis reported discovery of immature dental pulp stem cells (IDPSC) in 2006. Stem cells are immature, unspecialized cells that have the potential to develop into many different cell lineages via differentiation. By the conventional definition, these cells can renew themselves indefinitely through “self-renewal” and they vary in terms of their location in the body and the type of cells that they can produce.⁵ Stem cells are generally defined as clonogenic cells with the capacity to both self-renew and give rise to differentiated cells.

Properties

There are few properties of stem cells that make them unique:

Proliferation: Stem cells have the unique ability of replicating themselves in to millions of cells.

Blank Cells: Stem cells are basically unspecialized cells that have the capacity to give rise to specialized cells like heart, nerve, muscle etc

Differentiation: It is the property of stem cells to differentiate into specialized cells through various signalling processes

Characteristics of stem cells ⁴

1. **Totipotency:** Produce all types of cells .
2. **Pluripotency:** Produce all types of cells from three germ layer.
3. **Multipotency:** More than one adult cell (MSC) is distinguished.
4. **Unipotency:** Produce one particular cell type

Stem cells are of two types. ⁴

- Embryonic stem cells
- Adult stem cells

Dental stem cells¹⁰

The search for more accessible MSC than those found in bone-marrow has propelled interest in dental tissues.

Five types of dental MSC are isolated with the following characteristics:

1. Dental pulp stem cells from pulp of permanent teeth especially from third molars;
2. Stem cells of human exfoliated teeth and immature dental stem cells from primary teeth;
3. Periodontal ligament stem cells;
4. Stem cells from apical papilla;
5. Dental follicle progenitor cells.

In Orthodontics & Dentofacial Orthopaedics: Repair of Alveolar Bone Defect:

Orthodontic treatment warrants extraction of premolars for correction of malocclusion. During extractions, accidentally buccal plates can be lost leading to alveolar bone defect,¹ these defects can be filled with stem cells to avoid the risk of dehiscence and periodontal issues after the spaces have been closed by

retraction. Alveolar cleft osteoplasty can be successfully done with stem cells

Remodelling and Regenerating Oral Tissues:

Remodelling of the alveolar bones is important in regenerating tissues. Stem cells play a pivotal role in controlling this phenomenon coupled by local signaling/growth factors and systemic hormones.

Distraction Osteogenesis:

Stem cells can induce mobilization of osteoblastic and osteoclastic cells. Stem cells can accelerate bone regeneration in the distraction gap and enhance consolidation.

Temporomandibular Defects:

Degenerative bone diseases including TMJ defects can be bioengineered with stem cells. Cells from various sources like articular cartilage cells, fibroblasts, mesenchymal stem cells have been used to reconstruct TMJ

Bioroot Engineering: It is the amalgamation of stem cells from apical papilla (SCAP) and Periodontal ligament stem cells (PDLSCs).

Rapid maxillary expansion

RME is similar to DO histologically. During RME, a gap in the midpalatal suture is created which is filled with blood and granulated tissue and followed by active bone formation. The expanded arch width relapses unless followed by an appropriate retention period. Therefore, providing a strategy to accelerate bone formation in the midpalatal suture might shorten treatment and retention period, achieve stability and prevent relapse. Because of the ability of SCs to differentiate into osteogenic cells, injection of SCs seems to have the ability to accelerate the process of bone formation. In Ekizer et al in their animal study, local injection of MSCs into intermaxillary suture after force application resulted in increased new bone formation in the suture by increasing the number of osteoblasts and new vessel formation¹. Thus, locally applied MCSs to the expanded maxilla might be a useful and practical treatment strategy to accelerate new bone formation in midpalatal suture and to shorten the treatment and retention period for patients undergoing orthopedic maxillary expansion.

Accelerated OTM

OTM is achieved by the remodeling of periodontal ligament (PDL) and alveolar bone in response to mechanical loading. The initiating inflammatory event at compression sites is caused by constriction of the PDL microvasculature, resulting in a focal necrosis, followed by recruiting of osteoclasts from the adjacent marrow spaces. These osteoclasts are mostly derived from hematopoietic SCs. Hence; SCs could be used to accelerate OTM by providing progenitor cells.¹

Advantages in Orthodontics

Shorter treatment time Embryonic stem cells have been differentiated into cartilage cells and implanted on artificially created cranial osseous defects. Mesenchymal stem cells (MSCs) express and secrete various factors like (SDF-1), (VEGF), (bFGF), (MMPs), and other cytokines that are important for angiogenesis. Various bioactive factors are secreted by the stem cells that suppress the local immune system, inhibit fibrosis, and stimulate mitosis. Thus, by increasing the rate of healing and regeneration, treatment time can be reduced.

Periodontal health consideration

Orthodontic treatment is successful when the periodontium is healthy without any signs of diseases and defects. Human PDLSCs get attached to the surfaces of the alveolar bone and tooth root when integrated into the PDL tissue. Dental pulp stem cells (DPSCs) have the highest osteogenic potential among bone marrow mesenchymal stem cells (BMMSCs) and periosteal cells.

Lesser Root Resorption

External apical root resorption is the most common and undesirable sequelae of Orthodontic treatment. Various derivatives of stem cells may be used prior to the treatment, to prevent root resorption or post treatment to repair the damage^{10,11,12}

Patient benefits

Bone marrow mesenchymal stem cell (BM-MSC)–treated wounds exhibit significantly accelerated wound closure, with increased re-epithelialization, cellularity, and angiogenesis

Future perspectives

Periodontal Regeneration

Periodontium can be regenerated successfully by transplantation of ex vivo prolonged autologous MSCs as shown by Kawaguchi et al. It is also confirmed by Hasegawa et al, that periodontal defects can be managed by reimplantation of these cells. Regeneration of pulp and damaged coronal dentin Dental Pulp Stem Cells (DPSCs) can form ectopic dentin and related pulp tissue as demonstrated by Gronthos et al.

Tooth Regeneration⁴

Three key elements involved in tooth regeneration which include: Inductive morphogenes, Stem cells, Scaffold

Regeneration of tooth can be carried out in the following steps: First, the adult stem cells are harvested. Stem cells are arranged into a scaffold that provides optimized environment. Cells are instructed with targeted soluble molecular signals spatially and gene expression is read

Bioengineered Teeth

A method has been developed to regenerate tooth buds in a single procedure by combining dental pulp and bone marrow on a scaffold and implanting this into surgically created defects. After a number of months, the construct led to organized dentin, enamel, pulp, cementum, and periodontal ligament surrounded by regenerated alveolar bone, suggesting a method that could translate directly to humans⁶

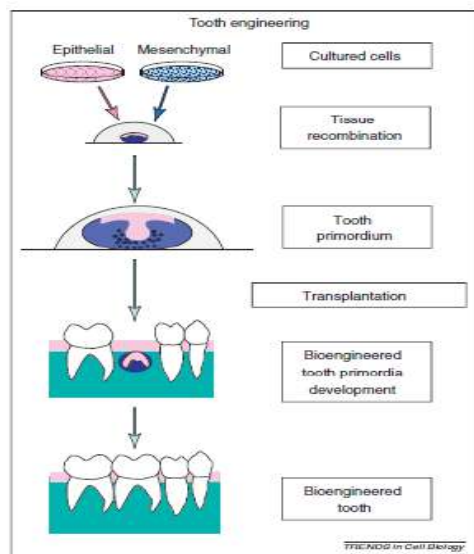


Figure 2. Diagrammatic representation of the generation of biological replacement teeth. Suitable sources of epithelial and mesenchymal cells are expanded in culture to generate sufficient cells. The two cell populations are combined to bring the epithelial and mesenchymal cells into direct contact, mimicking the *in vivo* arrangement. Interaction between these cell types leads to formation of an early stage tooth primordium, equivalent to a tooth bud or cap, around which the mesenchyme cells condense (dark blue dots) (see also Box 1). The tooth primordium is surgically transplanted into the mouth and left to develop.

Stem Cell Banks

Cryopreservation or banking of stem cells maintains the viability of cells indefinitely. During cryopreservation, the

cells are put to sleep through a process called vitrification, in which the tissue is placed in liquid nitrogen at a temperature of -196 degrees Celsius. The cryopreservation process stops all cellular metabolism involving both cell growth and cell death. The cells preserved today can be applied to future regenerative therapies.

Conclusion

Stem cells play an important role starting from embryonic development through adulthood. Their potential needs to be unlocked as stem cell therapies are employed to cure diseases identifying specific growth factors and their mechanisms in the natural processes will definitely help to improve our understanding of molecular triggering and regulating processes of stem cells. Nowadays stem cell therapy is one of the most favoured areas of research in craniofacial tissue engineering. However, the fact is that our exposure to this technology remains limited, as it is extremely expensive. Isolation and storage requires a lot of experience, as also high storage and good transport facilities. In short stem cell therapy is a multidisciplinary approach.

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Case report

ORTHOGNATHIC SURGERY USING VIRTUAL SURGICAL PLANNING

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****Dr Manoj Kumar K P.

Abstract

Orthognathic surgery is a distinct endeavour in facial surgery: a patient's appearance and occlusal function can be ameliorated exceptionally, the patient's quality of life. Successful outcomes in orthognathic surgery depends on close collaboration between the surgeon and the orthodontist across all stages of treatment. Virtual surgical planning promotes a more meticulous analysis of dentofacial deformity and preoperative planning. This article reports the case of a patient diagnosed with nasomaxillary deficiency and mandibular prognathism treated with virtual surgical planning.

Key words: Orthognathic, BSSO, Le Fort 1 osteotomy

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Introduction

Orthognathic surgery procedures are used to correct skeletal angle class II and class II deformities, dento maxillofacial deformities, mandibular retrognathia, and maxillofacial asymmetries.¹⁻⁴ Class III skeletal malocclusion may result from mandibular prognathism, maxillary deficiency, or a combination of both. Maxillary deficiency is more frequent, accounting for 60%–63% of the cases of this type of malocclusion.⁵ Orthognathic surgery is a complex type of facial surgery that can have a profound impact on a patient's occlusal function and facial aesthetics.⁶ Close collaboration between the maxillofacial surgeon and an orthodontist is required and the surgical team must have a strong foundation in facial analysis and firm understanding of the maxillofacial skeleton to achieve surgical success.

Case report:

A 26-year-old gentleman reported to our department with a chief complaint of forwardly placed lower jaw. Patient was diagnosed with nasomaxillary deficiency and mandibular prognathism. Reverse overjet was measured 20mm. Presurgical

orthodontics was done. Airway assessment was done prior to surgery. Virtual surgical planning was done and the surgical splint and cutting guides were fabricated. The surgical plan was Le Fort I advancement 9mm and Bilateral Sagittal Split Osteotomy Setback 11mm.

Surgical procedure

Under nasotracheal intubation GA was administered. LA with adrenaline administered to the local site. Circumvestibular incision placed extending from maxillary first molar to opposite first molar. Mucoperiosteal flap reflected Le Fort I osteotomy was performed and 9 mm advancement was done. Occlusal splint was placed. MMF given. Fractured segment fixed using 1titanium miniplates and screws. Circumvestibular incision placed from anterior border of ramus to mesial aspect of lower first molar bilaterally. BSSO cut was done. Mandibular setback done (11mm) by using final splint. Occlusion achieved. Fixation done by using titanium miniplate and screws. Cinch suturing and V-Y closure done. Wound closure done by using (4 - 0) vicryl. Patient extubated uneventfully. Postoperative period was uneventful

Pre operative



Figure-1



Figure-2



Figure-3

Post operative



Figure-4



Figure-5



Figure-6

Discussion

Prediction of the soft-tissue profile is of utmost importance in treatment planning and patient motivation. The visual impact of the face totally depends on the form and

proportion of the soft tissues. Landmarks on lateral cephalograms have been shown to be highly reproducible.^{7,8} however, the accuracy of this two-dimensional method may be impaired by distortion or magnification.⁹ Le Fort I osteotomy has the

potential to change the mid-facial region. However, despite accurate planning and surgery, it is onerous to predict soft tissue changes. With the recent advances in three-dimensional (3D) imaging, computer-assisted surgical planning and simulation are now regularly used for analysis of craniofacial structures and improved prediction of surgical outcomes in orthognathic surgery.¹⁰ Maxillomandibular advancement (MMA) may be performed for complex malocclusion and OSA. Although orthodontic management followed by MMA has been the gold standard in managing complex cases, the surgery first approach for treatment of malocclusion has increased in popularity because of decreased treatment time and improved patient quality of life.¹¹ The amalgamation of facial CT images and dental arch scans is crucial in computer-aided planning and it is more precise when reference points are consistent for both modalities.¹² The accuracy of the translation of the maxilla with computer-assisted planning for orthognathic surgery was < 1 mm in the study of Hsu and colleagues, indicating that this type of planning is accurate for the maxilla.¹³ The Stokbro group found that the mean linear differences for the maxilla, mandible and the chin segment in all

three planes were within 0.5 mm, while the mean precision, measured as the standard deviation, had the smallest deviation superioinferiorly, followed closely by mediolateral deviation, and finally the largest deviation was found antero posteriorly.¹⁴ De Riu and co-workers found that virtual surgical planning presented a high degree of accuracy, with an average error of 1.98 mm for linear measurements and 1.19° for angular measurements.¹⁵ A lot of studies compared computer-assisted planning with classical planning and found commendable accuracy results in all bony segments for computer-aided planning.^{16,17}

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Review

ORTHODONTIC BONE SCREWS

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Abstract

The usage of orthodontic bone screws has gained immense popularity and has been revitalizing the treatment of complex malocclusions. They are larger in dimension than the regular mini-implants and are therefore placed in areas of high density like the infrazygomatic crest in the maxilla and buccal shelf in the mandible. Owing to the difference in size they are placed away from the roots and hence, the name extra-radicular implants seem to be a befitting one. This article aims to provide an overview of the salient features of orthodontic bone screws.

Keywords: Anchorage, IZC infrazygomatic crest, orthodontic bone screws, buccal shelf

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Introduction

Anchorage loss is one of the prime concerns in the field of orthodontics. Whenever an anchorage is derived from the posterior segment for retraction, almost all such cases showed unwanted movement of posterior segment. Many methods like extra-oral anchorage, increasing number of anchor units were tried, but all these methods had its own demerits and patient's compliances.

The introduction of mini screws followed by bone screws in orthodontics has been used successfully to provide skeletal anchorage for various tooth movement with less failure rates than regular mini-implants and doesn't require any extensive surgical intervention for their placement. It also helped the clinician in converting the borderline extraction cases to non-extraction and borderline surgical cases to non-surgical cases¹

The Bone Screws (infra-zygomatic and buccal shelf) can just provide that ray of

hope together with limiting the time required for re-treatment. However, they need to be used judiciously. The anatomic limits, art, biomechanical perspectives, and the side effects are of prime considerations to master the technique.

Anatomy of Infra Zygomatic Crest and Buccal Shelf area

IZC is the palpable bony crest in the maxilla, which is situated lateral to the roots of maxillary 1st and 2nd molars and extends about 2cms to the Zygomatico maxillary suture².

Buccal shelf lies on the buccal alveolar bone of mandible between 1st molar regions to the external oblique ridge³. Usually in Indians the buccal shelf region is thin, hence implants are placed in the external oblique ridge. The IZC and Buccal shelf areas are considered as safe zones for implant placement because it is devoid of important anatomical structures like roots and nerves and it has good quality and quantity of bone to provide excellent primary stability. Bone density of D1>1250 HU is present in both IZC and buccal shelf area⁴.

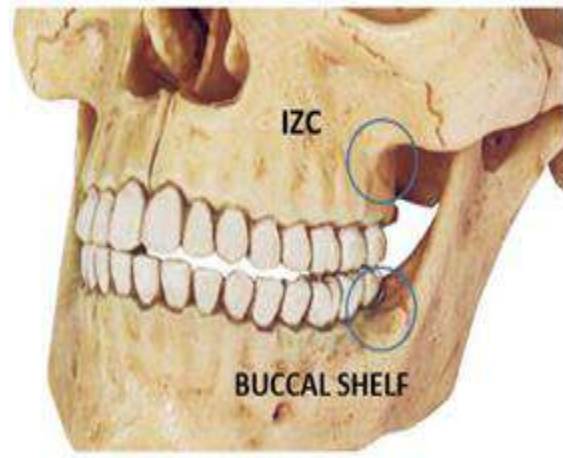


Figure 1: Anatomy of IZC and buccal shelf

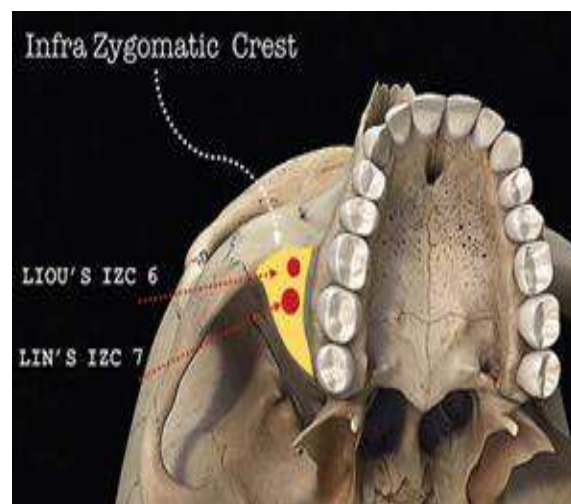


Figure 2: Sites for placement of bone screws in the IZC

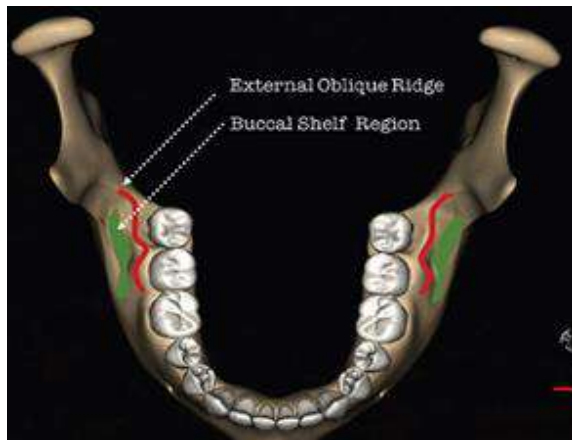


Figure 3: Sites for placement of bone screws in the buccal shelf



Figure 4: Sites for placement of bone screws in the mandible.

Case selection criteria for bone screws

Orthodontic bone screws can be used in almost every clinical situation that a micro-implant is used for, except that they cannot be placed inter-dental purely

because of their larger dimension. They can be used for molar uprighting, segmental, and full arch distalization, intrusion of single tooth to full arch, protraction and retraction of dentition and for any other anchorage needs.

However, two most specific indications would be – full arch distalization of maxillary and mandibular dentition to camouflage a Class II and a Class III malocclusion and for distalization of arches in re-treatment cases of anchorage loss, which are otherwise difficult to be done with a regular micro-implant or time-consuming.^{5, 6}

Sites for placement of bone screws

The preferred site for placement of bone screws in the maxilla is the infra-zygomatic crest which lies higher and lateral to the 1st and 2nd molar region [Figure 2].^{5,6} While some authors (Lin) prefer bone screws to be placed in the 1st and 2nd molar region others (Liou) opine a more anterior placement, closer to the MB root of the 1st molar.

The preferred site for placement of bone screws in the mandible is the buccal shelf area, which lies lower and lateral to the 2nd molar region [Figures 3 and 4]. Buccal

shelf bone screws can also be placed in the external oblique ridge of the mandible if the buccal shelf area is found to be too thin or too deep, as is so commonly seen in the Indian population. Both the areas have D1 (>1250 HU) quality bone.^{5,6}

Preferable sizes of orthodontic bone screws

Orthodontic bone screws in the maxilla (IZC) are available in two sizes commonly (manufacturer specific) – 12 and 14 mm in length and 2 mm in diameter. When the soft tissue in the buccal vestibule is thick as in most clinical situations, the preferred choice is a 14 mm screw which have 7 mm of head and collar area and 7 mm of cutting spiral. Orthodontic bone screws of 12 mm length are preferred in cases of thin soft tissue at the vestibule. The length of cutting spiral, head, and collar dimensions may vary according to the choice of manufacturer.

Bone screws in the mandible are available in two sizes commonly (manufacturer specific) – 10 mm and 12 mm in length and 2 mm in diameter. Buccal shelf area in the Indian population is mostly found to be thin and deep; therefore, the preferred choice will be a 12-mm screw.

The head and collar sizes of both the variants (10 and 12 mm) are almost the same but may vary according to the choice of the manufacturer.

Procedure

Insertion technique for buccal shelf

The region distal to mandibular 1st and 2nd molar should be palpated for triangular bony buccal shelf it is usually located between 1st molar and 2nd molar an indentation should be made with explorer. It will act as site of insertion of the buccal shelf. It is placed between 1st and 2nd molars. Insertion should be done in the upright direction. After couple of turns, driver direction is changed towards the tooth so that the tooth movement will be clear of implant. Dr Rungsi compared buccal shelf in lower 1st, 2nd and 3rd molar, Insertion point should be in the mucogingival junction. Buccal shelf should be inserted in such a way that it should be upright and near parallel to the tooth. The hook should stay in level to the CEJ of the adjacent tooth. About 340-450grms of force can be applied per buccal shelf screws⁷.

Insertion of IZC implants

An indentation should be made 14-16mm above and perpendicular to the maxillary occlusal plane, that is along the long axis of the tooth. After 1mm insertion into the cortical bone, the bone screw should be angulated to the 55-70degree.³ So that the bone screw will be placed in the thicker bone. There should be 1.5 to 2mm screw visibility. Immediate loading is possible and it is capable of withstanding 300-350grms of force per IZC bone screw.⁶



Figure 5,6: A view of the IZC implants in place

Complications

The most common complication is soft tissue irritation and this can be avoided by placing the implants 2.5mm away from the soft tissue. Another complication is the perforation of the maxillary sinus. It is most commonly seen in 1st molar region usually seen in case of missing posteriors⁸. The maxillary sinus perforation up to 2mm recover by itself. Hence orthodontic treatment can be carried out. Care should be taken that the bone screw selected should be of suitable length and width according to the bone depth. If in case there is early loosening of the screw, it should be removed and reinserted in the different site.

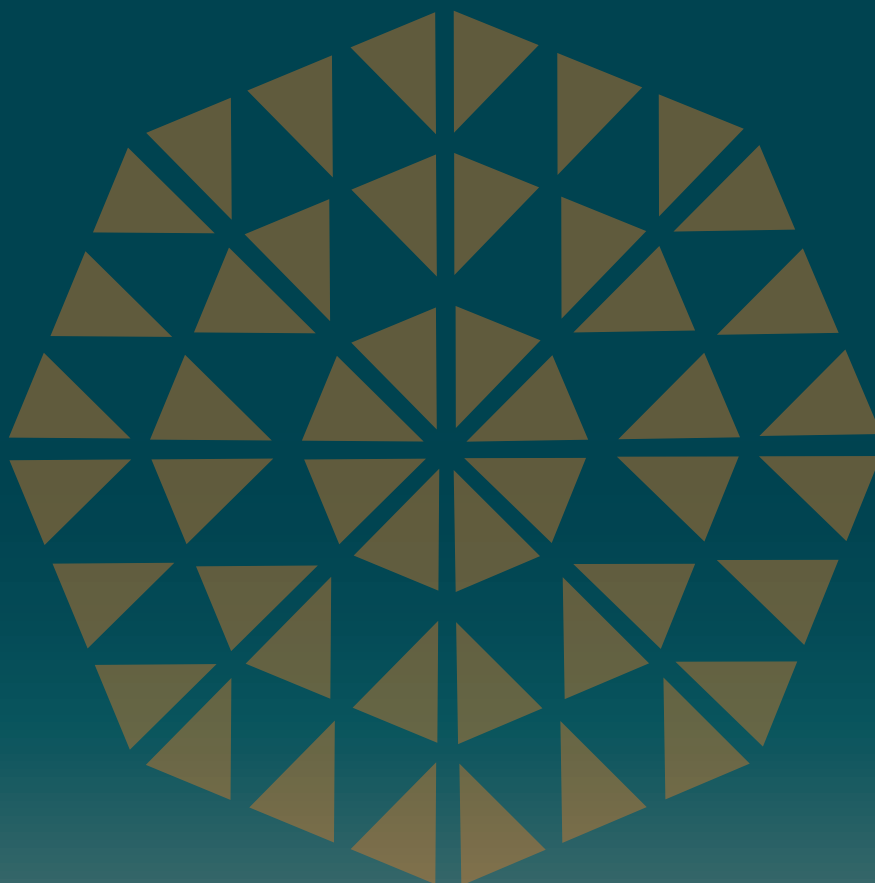


Conclusion

The invention of IZC and Bone screw has been a revolution in the field of Orthodontics. It provides absolute intraoral skeletal anchorage and helped to bring about greater changes in the skeletal, dentoalveolar and soft-tissue changes. The invention of bone screws helps the clinicians to convert the borderline extraction cases into non extraction cases and surgical cases into non-surgical cases which upheld the patient compliance and better treatment results.

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