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Bone screws in orthodontics- A glimpse through its various pertinence

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Abstract
Anchorage loss is one of the prime concern 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 extraoral anchorage, increasing number of anchor units were tried, but all these methods had its own demerits and patients compliances. The introduction of miniscrews followed by bonescrews in orthodontics has been used successfully to provide skeletal anchorage for various tooth movements. It also helped the clinician in converting the borderline extraction cases to non-extraction and borderline surgical cases to non-surgical cases. This article is aimed at providing an overview to the orthodontic bone screws.

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

Introduction
The biomechanics in orthodontics, being a backbone has various impact on the tooth movement. The main pillar of biomechanics in orthodontics is the Anchorage. The best anchorage preparation will aid in transforming borderline surgical case to non-surgical and also extraction case to non-extraction [1]. In recent era, Bone screws have become increasingly popular as a preferred method of skeletal anchorage in the maxillary and mandibular arch.

Evolution
Gains forth and Higley in 1945 introduced the concept of implant supported anchorage. The extra radicular bone screw in orthodontics has reached the pinnacle in attaining absolute anchorage in the past decade.
Melson and Uribe in 1998 introduced the concept of gaining anchorage from Infrazygomatic crest for various tooth movement like intrusion and retraction, although the IZC screw were developed by Dr. Eric Liou from Taiwan in recent years [2].

Anatomy of IZC 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 suture [3].
Buccal shelf lies on the buccal alveolar bone of mandible between 1st molar regions to the external oblique ridge [4]. 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 live 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 area [5].

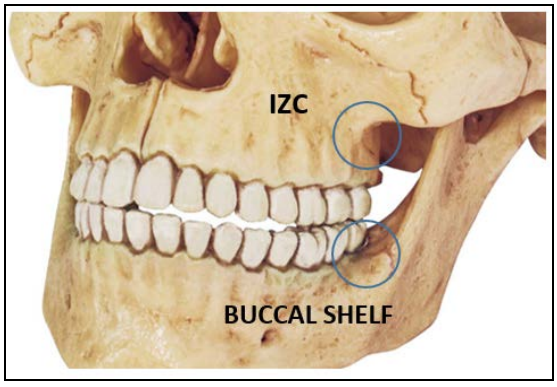

Fig 1: Anatomy of IZC and Buccal Shelf

Biomechanics Involved in Extra Alveolar Bone Screw
The tooth movement changes according to the level of application of the force with respect to the centre of resistance, if the force vector is passing through the center of resistance of maxilla or mandible there will be pure translator movements. According to Roberts *et al* [6], extra alveolar implants placed in the buccal shelf area act as an excellent non extraction treatment option in case of class III with anterior open bite. When the retraction force is applied there will be intrusive effect on the entire posterior segment and extrusive effect on the anteriors. There by allowing the counter clockwise rotation of mandible. Similarly in case of IZC implants there will be clockwise rotation seen with respect to maxilla due to force acting occlusal to the center of rotation.

Case Selection for Extra-Alveolar Bone Screws
Infrazygomatic Crest Implants
En masse retraction of maxillary arch Distalization with sliding Mechanics Posterior intrusion Asymmetry correction of occlusal plane Cantilever anchorage in impacted canine traction Orthognathic surgery preparation in class III Cases.

Buccal Shelf Implants

Class III Camouflage treatment Retraction\ Distalization in excess crowding mesial movement of molars and posterior intrusion Asymmetry correction of occlusal plane Cantilever anchorage in impacted canine traction Orthognathic surgery preparation in class II cases

Advantages

Implants are placed away from the roots of maxillary and mandibular teeth; hence less damage to the roots and also does not interfere with the mesio-distal movement.

Good amount of cortical bone support allowed the use of implants with greater length and diameter Low failure rate when compared to the conventional mini implants It allows the use of multi vector forces which helps in addressing the complex issues

Sizes and Materials Available in Orthodontic Bone Screws

Bone screws are generally available as titanium and stainless steel. The screw size ranges from 10-14mm in length and minimum diameter of 2mm it is available as short or long collar depending on the anatomic site. Titanium alloy has lower failure rate than stainless steel when placed in cortical bone. Overall success rate of 93.7% indicates both titanium and stainless steel are clinically acceptable [4].

Parts of implants

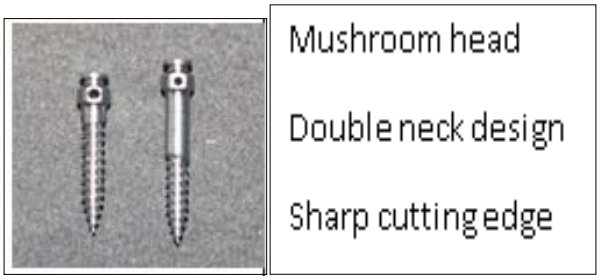

Fig 2: IZC and BUCCAL SHELF implants

Table 1

Type and size	Indication	Location
2×12mm	Maxillary retraction Palatal impaction Mandibular retraction	IZC Palate Buccal shelf
2×14mm	Mandibular retraction Upper impacted cuspid Horizontally impacted 3rd molar Mandibular protraction	IZC Ramus Buccal shelf

Procedure

Sterilization protocol: the bone screws should be sterilized with the insertion device, including handles and blades before use. Steam sterilization with an autoclave is recommended at a temperature of 121 degree Celsius or 249° F with a minimum of 25 min.

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 screws [8].

Fig 3: Orthodontic bone screw insertion in buccal shelf

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 should be visible. Immediate loading is possible and it is capable of withstanding 300-350grms of force per IZC bone screw [7].

Fig 4: Orthodontic bone screw insertion in IZC

Complications

Cheek mucosa irritation
Maxillary sinus perforation
Ulceration

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 posteriors [9]. The maxillary sinus perforation up to 2mm recover by itself. Hence orthodontic treatment can be carried out. Care should be taken that the bonescrew 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 Bonescrew 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 bonescrews 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.

References

1. Clerck H, Geerinckx V, Siciliano S. The zygoma anchorage system. J Clin Orthod,2002:36:455-9
2. Lin J, Roberts WE. Guided Infra-zygomatic screws: Reliable maxillary arch retraction. Int J Orthod Implantol,2017:46:4-16
3. Pathak S, Patil T, Mahamuni A, Jaju K, Rai R. Mandibular buccal shelf and infra zygomatic crest – A safe zone for mini screw insertion. Indian J Orthod Dentofacial Res,2019:5:60-62.
4. Ghosh A. Infra-zygomatic crest and buccal shelf-Orthodontic bone screws: A leap ahead of micro-implants-Clinical perspectives. Journal of Indian Orthodontic Society,2018:52:127-141.
5. Singh K, Kumar D, Jaiswal RK, Bansal A. Temporary anchorage devices–Mini-implants. National Journal of Maxillofacial Surgery,2010:1:30
6. Roberts WE, Viecilli RF, Chang C, Katona TR, Paydar NH. Biology of biomechanics: finite element analysis of a statically determinate system to rotate the occlusal plane for correction of a skeletal Class III open bite malocclusion. Am J Orthod Dentofacial Orthop, 2015:148(6):943-55.
7. Lin J, Eugene Roberts W. CBCT imaging to diagnose and correct the failure of maxillary arch retraction with IZC screw anchorage. Int I Orthop Implantol, 2014:35:4-17.
8. Almeida MR. Biomechanics of extra-alveolar mini-implants. Dental Press J Orthod,2019:24(4):93-109.
9. Reiser GM, Rabinovitz Z, Bruno J, Damoulis PD, Griffin TJ. Evaluation of maxillary sinus membrane response following elevation with the crestal osteotome technique in human cadavers. Int J Maxillofac Implants,2001:16:833-840.