# ROLE OF BONE SCREW (IZC & BSS) IN SKELETAL ANCHORAGE SYSTEM – A REVIEW ARTICLE

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**Abstract**
Skeletal anchorage is popular among orthodontist now days, as it play an important role in treatment of variable malocclusion due to its size, biocompatibility, patient compliance, low cost and with high success rate. There are variety of skeletal anchorage systems, among all bone screws (IZC and BSS) are trending, as with bone screw we apply heavy force to distalize and rotate entire dentition. Bone screw have several advantage over mini-implant and with high success rate. Various severe skeletal malocclusion in adults now can successfully treated with use of IZC and BSS.
**Key words**: Anchorage, Skeletal Anchorage system, Infra Zygomatic Crestal Screw, Buccal Shelf Screw, Mini-implant.

## Introduction

Anchorage control is a key to success in orthodontic treatment. In most of the orthodontic case for better result anchorage planning is utmost important. Anchorage is derived extra-orally (with the use of headgear which is uncomfortable and noncompliant to some patients) and intra-orally (with the use of transpalatal arch and lingual arch)[1].

Introduction of various types of intraoral skeletal anchorages like onplants, retromolar implants, palatal implants, mini-plates and bone screws etc are boon to orthodontics (figure 1). Skeletal Anchorage Devices have become one of the absolute anchorages which give better result with proper utilization of space and least discomfort to the patients[2, 3].

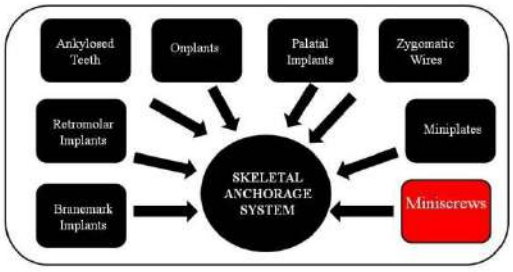


Figure 1. Various Skeletal Anchorage Systems

There are many type of skeletal anchorage system, recently Bone Screws (Infra Zygomatic Crestal and Buccal Shelf ) gain popularity in orthodontics as it expand envelop of discrepancy[4, 5] (figure 2). With the use of these bone screws (IZC & Buccal shelf screw) now some extent of severe skeletal malocclusion can be treated. The focus of this article is on the recent trends of bone screw in orthodontics as a skeletally derived anchorage.

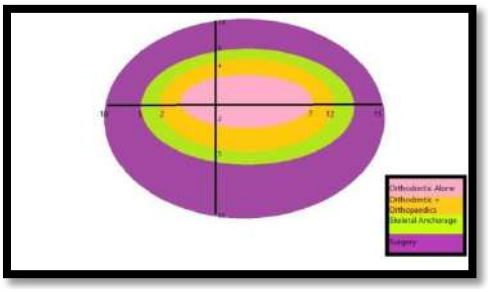

Figure 2- Envelop of discrepancy

INDICATIONS OF BONE SCREWS[6]

1. Positioning of Individual Teeth
    a. Missing Teeth – lack of anchorage
    b. Impacted teeth
2. Positioning Groups of Teeth
    a. Space closure
        i. Major incisor retraction
        ii. Incisor retraction and intrusion
    b. Protraction movement
        i. Maxillary posterior teeth
        ii. Mandibular posterior teeth
        iii. Entire mandibular arch
    c. Distalization movement
        i. Maxillary arch distalization in End on molar relation cases
        ii. Mandibular arch distalization in mild Class III cases
    d. Intrusion anterior or posterior teeth(but not both simultaneously)

MATERIAL USED IN TEMPORARY ANCHORAGE DEVICE

Material used for temporary anchorage device can be divided into three groups (figure 3),

a) Bio-tolerant
b) Bio-inert

c) Bio-active

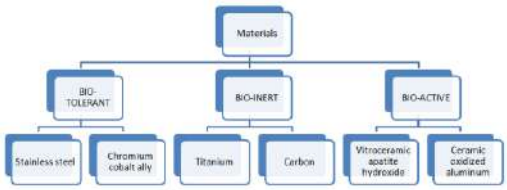


Figure3. Material used in TADS

**Comparison of Stainless steel and Titanium Alloy**[7]:-
Bone screw generally made by stainless steel instead of titanium alloy. All those skeletal anchorage area where increase amount of force amount required stainless steel preferred over titanium alloy. Comparative properties of stainless steel with Titanium alloy are mention in table 1.

| | **Stainless Steel** | **Titanium Alloy** |
|---|---|---|
| Elastic Modulus(Gpa) | 193 | 100 |
| Yield Strength(Mpa) | 170-1210 | 795 |
| Tensile Strength (Mpa) | 480-1300 | 860 |
| Ductility (%) | 12-14 | 10 |

Table1. Comparison of Stainless steel and Titanium Alloy

DIFFERENCE IN SIZES BETWEEN BONE SCREWS AND MICRO-IMPLANTS
While the normal size of a mini-implant between 6 and 11 mm in length and 1.3–2 mm in diameter depending on the clinical situation, it needs to be used for; bones screws are big in size ranging from 10 - 14 mm in length and diameter of 2 mm. Just like micro-implants have a short or a long head one, bone screws are also available as a short or a long collar (figure 4) depending on the site and the clinical need for specific malocclusion. The head shapes is mushroom shaped just like mini-implant.[7]


Figure4.Parts of Bone Screw

EXTRA-RADICULAR ORTHODONTIC BONE SCREWS (A NEWER TREND IN SKELETAL ANCHORAGE SYSTEM)
Extraradicular anchorage system evolved in the mandible as mandibular buccal shelf (MBS) OrthoBoneScrews® (OBS) (Newton's A, Hsinchu City, Taiwan)[8]. These stainless steel (SS) TADs reported maximum success rate (~93%), still 1.9% of patients failed, as evidenced by bilateral failures have found in the literature within 6 months.[9]

MBS mini-screws have enormous effect in treating skeletal malocclusion. Site of placement of bone screw is show in figure.[10-12] OBSs are placed in MBSs for retracting lower dentition in treating class III cases and buccal cross-bite and mandibular impaction cases. OBSs are inserted into the infra-zygomatic crest (IZC) region for retracting upper dentition in extracted relapse cases or where there is a mild proclination, up-righting horizontally impacted mandibular molars. Both the MBS and IZC bone screw inserted buccally to the roots of the molars, so that skeletal anchorage used for full arch tooth movements (figure 5).[13]


Figure5. Site of Bone screw (IZC & Buccal Shelf) placement

DIMENSIONS OF BONE SCREW
- Diameter – 2 mm
- Length – 10 mm ,12 mm, 14mm
  The minimum bone required for stability of bone screw in minimum 8mm.

ARMAMENTARIUM
- Longer Blade – 78 mm
- Rotatable Handle – 100 mm

PLACEMENT CRITERIA
IZC initial point of insertion is between the 1st and the 2nd molar inter-dentally and 2 mm superior the muco-gingival junction in the alveolar mucosa. The screw is directed at 90° to the occlusal plane at this point, after the initial notch direction is changed by 55°–70° toward the tooth, downward and directing the screw to the infra-zygomatic area of the maxilla. Immediate loading is acceptable and a force of up to 300–350 g bearded by a single bone screw.[7,14]

Buccal shelf area of mandible is initial point between the 1st and the 2nd molar and 2 mm inferior the mucogingival junction. The self-drilling screw is directed at 90° to the occlusal plane, after the initial notch the driver direction is changed by 60°– 75° toward the tooth, upward and directed the screw to the buccal shelf area of the mandible. Immediate loading with 300–350 g beared by a single bone screw.[7,14]

BIOMECHANICS
Full arch distalization is also possible with the mini-implant which are placed in the inter-radicular area[15], only difference is the chances of root touching the

implant is always there and 2 step implant placement have to be done in case of full arch distalization where as while using IZS and BSS easily placed posterior and in single step with quite higher force we can do distalization with no drawback of any root interference during retraction.[16]

While distalization the upper arch (Class II Malocclusion) and lower arch (Class III Malocclusion) it is very important to note the 3rd molar presence and its position sometime due to lack of space we have to extract 3rd molar as well before the start of retraction.[17] During retraction or distalization of arches it is important to note that there is intrusive force in the posterior segment and extrusive force in the anterior segment, clockwise rotation of maxillary occlusal plane and anticlockwise rotation of occlusal place (figure 6). These moment and movement of teeth is useful while treating open bite specially hyper-divergent patients, but we have to take precaution of torque loss in the anterior teeth while retracting anterior segment in bimaxillary protrusion cases.[7,14]

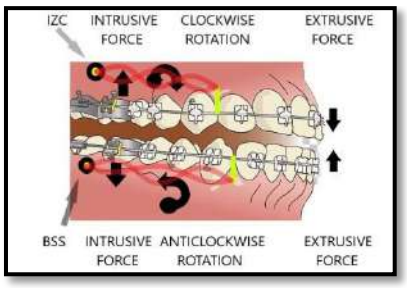


Figure6. Biomechanics of Bone Screw

SUCCESS AND COMPLICATIONS OF BONE SCREW

Success rate is depend on the stability of bone screw which is much high than (70-90%) as 2mm diameter resistant to fracture when compare to mini-implant as the site where we place IZC and BSS have D1 type of bone (very hard). There is hardly any major complication with bone screw, only minor complication like bleeding at the site, gingival overgrowth which is minimized by use of large head. Stainless steel BSS have no chances of breakage during normal circumstance but with the use of titanium alloy BSS breakage of tip is reported while placement as bone is very hard and titanium have less strength then stainless steel. Reports suggest overall failure rates of micro-implants to be 13.5% while bones screws to be – BSS (7.2%) and IZC (7%).[17-19]

CONCLUSION

As anchorage is the prime goal of many treatment of malocclusion and skeletal anchorage play a absolute role we must know the importance of every type of skeletal anchorage system with their pros and cons. Bone screw had many advantages over other skeletal anchorage system as it easy to place, patient compliance is high, no any major complication and most important that it is very useful in treating some sever skeletal or dental malocclusion which is not possible in older days. With the use of Bone Screw in treating malocclusion we restore optimal aesthetic and function.

Conflict of interest : No

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