

Success factors influencing infrazygomatic crest (IZC) miniscrew placement: a cross-sectional survey among orthodontists

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ABSTRACT

Background: Infrazygomatic crest (IZC) miniscrews are widely used as extra-alveolar temporary anchorage devices in orthodontics due to their biomechanical advantages and minimal dependence on patient compliance. Their success depends on multiple clinical and operator-related factors. **Materials and methods:** A cross-sectional survey was conducted among 100 orthodontists using a validated 20-item questionnaire. The questionnaire assessed implant selection, insertion techniques, loading protocols, complications, and perceived success factors. Data were analysed using descriptive statistics. **Results:** Titanium miniscrews were preferred by 74.4% of respondents. Most clinicians selected 10–12 mm length (82.1%) and 2.0 mm diameter (82.1%). Self-drilling technique (89.7%) and insertion angulation of 65–70° (76.9%) were commonly used. Immediate loading was preferred by 61.5% with forces of 150–250 g (68.4%). A success rate greater than 90% was reported by 72% of practitioners. Bone thickness, angulation, and oral hygiene were identified as key determinants of success. **Conclusion:** IZC miniscrews demonstrate high clinical success with consistent trends in clinical practice. Standardisation of placement and loading protocols may further enhance treatment predictability.

Keywords: Orthodontics, Infrazygomatic crest (IZC), Temporary anchorage devices (TADs), Skeletal anchorage, Miniscrews, Orthodontic biomechanics.

INTRODUCTION

Temporary anchorage devices (TADs) have revolutionized contemporary orthodontic treatment by providing absolute skeletal anchorage independent of patient compliance. Their introduction has enabled clinicians to perform complex tooth movements with greater precision while minimizing undesirable reciprocal effects associated with conventional anchorage systems. Compared with extra oral appliances and inter maxillary elastics, TADs offer improved patient acceptance, enhanced biomechanical control, and reduced treatment duration.¹

Among the various anatomical sites available for TAD placement, the infra zygomatic crest (IZC) region has emerged as a reliable extra-alveolar

anchorage site because of its dense cortical bone, favourable anatomical location, and reduced risk of root interference.^{2,3} The use of IZC miniscrews has gained widespread popularity owing to their ability to facilitate en-masse retraction, maxillary distalization, vertical control, correction of Class II malocclusions, management of gummy smile, and treatment of asymmetries. These applications have expanded the scope of non-extraction and camouflage treatment approaches, making IZC anchorage an indispensable component of modern orthodontic biomechanics.^{2,3,4}

Successful clinical performance of IZC miniscrews depends on several factors, including implant dimensions, screw material, insertion technique,

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angulation, cortical bone thickness, loading protocols, force magnitude, oral hygiene, and operator experience.^{5,6,7,8,9} Appropriate selection of these parameters is essential for achieving adequate primary stability and minimizing complications such as screw mobility, soft tissue inflammation, sinus perforation, and premature failure. Previous studies have highlighted the importance of biomechanical and anatomical considerations in determining the long-term success and stability of temporary anchorage devices.^{10,11,12}

In addition to anatomical and biomechanical factors, clinician-related variables such as experience, treatment philosophy, and preference for specific placement protocols may influence the success of IZC mini screws. Variations in screw dimensions, insertion angles, loading strategies, and management of complications have been reported among orthodontists, reflecting the absence of universally accepted clinical guidelines.^{11,12} Although several studies have investigated the success rates and biomechanical characteristics of IZC mini screws, relatively limited information is available regarding contemporary practice patterns and clinicians' perceptions of the factors contributing to successful placement and stability.¹³ Understanding the preferences and experiences of orthodontists is important for identifying common trends, recognizing factors associated with successful outcomes, and promoting evidence-based standardization of clinical procedures. Establishing consensus regarding implant selection, placement techniques, and loading protocols may improve treatment predictability, reduce complications, and enhance overall patient outcomes.

Therefore, the present cross-sectional survey was undertaken to evaluate the clinical practices and preferences of orthodontists regarding infra zygomatic crest mini screw placement and to identify the key anatomical, biomechanical, patient-related, and operator-related factors perceived to influence their success.

MATERIALS AND METHODS

This is an independent study with individualistic research work.

Study Design

The present study was a cross-sectional questionnaire-based survey conducted to evaluate orthodontists' preferences and perceptions regarding factors influencing the success of infra zygomatic crest (IZC) mini screw placement.

Study Population and Sample Size

The study included 100 orthodontists comprising postgraduate residents and practicing orthodontists. Participants were selected using convenience sampling and were invited to participate voluntarily.

Study Instrument

A structured and validated questionnaire consisting of 15 items is designed. The questionnaire is intended to assess clinical preferences and experiences related to IZC mini screws and was divided into the following sections:

- Demographic details of participants
- Implant selection and dimensions
- Placement techniques and insertion protocols
- Loading protocols
- Complications and management
- Factors influencing clinical success

Data Collection

The questionnaire was distributed electronically through online platforms, and responses were collected anonymously after obtaining informed consent from the participants. Participation was voluntary, and confidentiality of the respondents was maintained throughout the study. Only completely filled questionnaires were included for analysis.

Variables Assessed

The survey evaluated various parameters associated with the clinical success of IZC miniscrews, including implant material, length and diameter, insertion technique, insertion angulation, height from the occlusal plane, loading protocols, force magnitude, complications encountered,

reasons for failure, and clinician-perceived anatomical, patient-related, and operator-related factors affecting success.

Statistical Analysis

Descriptive statistics of frequencies and percentages are used¹²

No inferential statistical tests were applied as the study focused on descriptive evaluation of clinical trends.

RESULTS

There were 100 orthodontists who participated in the present study. The distribution of responses according to clinical preferences and perceived success factors is summarised in Tables 1 and 2 and Figure 1. Regarding the preferred implant material for infrazygomatic crest (IZC) miniscrews, titanium was selected by (74.4%,n=74) of respondents, whereas 25.6% preferred other materials. Concerning implant dimensions, most participants preferred a miniscrew length of 10–12 mm and a diameter of 2.0 mm, with both parameters being selected by (82.1%,n=82) of respondents.

Table 1: Technical specifications and placement protocols for IZC miniscrews.

Category	Clinical Parameter	Most Frequent Response	Percentage (%)
Material	Preferred Implant Material	Titanium	74.4%
Dimensions	Ideal Length	10–12 mm	82.1%
	Ideal Diameter	2.0 mm	82.1%
Technique	Insertion Technique	Self-drilling	89.7%
Positioning	Insertion Angulation	65–70°	76.9%
	Height from Occlusal Plane	12–15 mm	71.8%
Loading	Preferred Loading Protocol	Immediate Loading	61.5%
	Ideal Force Magnitude	150–250 g	68.4%

Table 2: Clinical Determinants, Outcomes, and Rationale for IZC Usage.

Category	Factor	Primary Response	Percentage (%)
Advantages	Primary Advantage over TADs	No root proximity	68.0%
	Key Biomechanical Benefit	Distalization & retraction	65.0%
Success Factors	Major Anatomical Factor	Bone thickness	60.0%
	Patient-Related Factor	Oral hygiene	65.0%
Stability	Best Indicator of Stability	Insertion torque	70.0%
Challenges	Most Common Complication	Screw mobility	48.0%
	Common Reason for Failure	All (Hygiene/Force/Angle)	55.0%

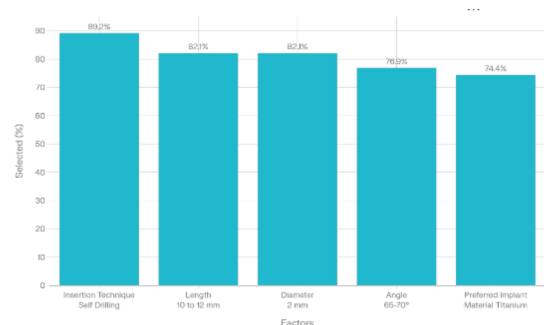


Figure 1 : Most selected factors by the orthodontists

In relation to insertion techniques, the self-drilling method was preferred by (89.7%,n=89) of orthodontists, whereas only a small proportion favoured alternative methods. An insertion angulation of 65–70° was considered ideal by (76.9% n =76) of respondents, while a placement height of 12–15 mm from the occlusal plane was preferred by 71.8%.

Regarding loading protocols, 61.5% of clinicians preferred immediate loading of IZC miniscrews. Most participants (68.4%,n=68) considered a force magnitude of 150–250 g to be optimal for clinical

applications. Among the clinical advantages of IZC miniscrews, (68%,n=68) of respondents considered the absence of root proximity as the major advantage over conventional temporary anchorage devices. Distalization and retraction were regarded as the principal biomechanical benefits by 65% of participants.

Bone thickness at the infrazygomatic crest region was identified as the most important anatomical determinant of successful placement by (60%,n=60) of respondents, whereas oral hygiene was considered the most significant patient-related factor influencing treatment outcomes by (65%,n=65). Furthermore, insertion torque was regarded as the best indicator of primary stability by (70%,n=70) of clinicians. With respect to complications, screw mobility was reported as the most common complication encountered during treatment by 48% of respondents. A combination of factors including inadequate oral hygiene, improper force application, and incorrect insertion angulation was identified as the most frequent cause of failure by 55% of orthodontists.

Most clinicians (72%,n=72) reported overall success rates exceeding 90%, indicating that IZC miniscrews are highly reliable anchorage devices with predictable clinical performance.

DISCUSSION

The present study evaluated the clinical preferences and perceptions of orthodontists regarding factors influencing the success of infrazygomatic crest miniscrews. The findings demonstrated a considerable degree of agreement among clinicians regarding implant dimensions, insertion techniques, loading protocols, and factors affecting long-term stability.

Oral hygiene was considered the most important patient-related factor, emphasizing the role of plaque control and maintenance in preventing peri-implant inflammation and failure. Screw mobility was the most frequently encountered complication in the present study. Loosening and mobility as the leading causes of failure of infrazygomatic miniscrews⁴.

Titanium emerged as the most commonly preferred implant material among the participants. This preference may be attributed to its excellent

biocompatibility, corrosion resistance, and favourable mechanical properties in achieving successful skeletal anchorage.^{5,13} Self-drilling was the most widely used insertion technique among orthodontists in the present study. The popularity of this method may be attributed to reduced chairside time, simplified placement procedures, and satisfactory primary stability, who observed high success rates are observed with self-drilling techniques^{5,7}.

The majority of respondents preferred miniscrews measuring 10–12 mm in length and 2.0 mm in diameter. Appropriate dimensions are essential for achieving adequate cortical bone engagement and primary stability. Suitable screw dimensions and insertion angulation play an important role in improving the success rate of IZC miniscrews^{6,8}. Most clinicians preferred an insertion angulation of 65–70° and a placement height of 12–15 mm from the occlusal plane. These parameters provide adequate cortical bone engagement while minimizing the risk of maxillary sinus involvement. Insertion angle and terminal insertion torque significantly influence the stability and survival of infrazygomatic crest bone screws⁸. Most respondents preferred immediate loading with forces ranging from 150 to 250 g. Temporary anchorage devices are capable of withstanding immediate orthodontic forces because their stability primarily depends on mechanical retention rather than osseointegration. Immediate loading protocols are effective when appropriate force magnitudes are maintained¹⁰.

Improper angulation, excessive forces, and inadequate oral hygiene may contribute to loss of stability and premature failure. Most participants reported success rates greater than 90%, indicating the high predictability and reliability of IZC miniscrews in contemporary orthodontic practice. Bone thickness was identified as the most important anatomical factor affecting success. Adequate cortical bone thickness contributes significantly to primary stability and long-term survival of miniscrews¹³.

Overall, the findings of the present study are in accordance with previous literature and suggest that appropriate implant selection, optimal insertion techniques, controlled force application, and maintenance of oral hygiene are essential for

achieving favourable treatment outcomes and minimizing complications associated with IZC miniscrews.

CONCLUSION

This study concluded that Infra zygomatic crest (IZC) mini screws demonstrated high clinical success and were widely accepted among orthodontists as reliable extra-alveolar anchorage devices. According to this study, Most clinicians preferred titanium mini screws measuring 10–12 mm in length and 2.0 mm in diameter, placed using the self-drilling technique with immediate loading. Bone thickness, oral hygiene, and operator experience were identified as the major factors influencing success, whereas screw mobility was reported as the most common complication. The majority of practitioners reported success rates exceeding 90%, highlighting the predictability and effectiveness of IZC mini screws in clinical practice. These findings emphasize the importance of appropriate implant selection, insertion protocols, and maintenance of oral hygiene avoiding improper angulation, excessive force, thereby preventing the failure and to achieve favourable treatment outcomes. Further studies are warranted to establish standardized guidelines and enhance the long-term success of IZC mini screw therapy.

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