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Optimizing Orthodontic Treatment Outcomes: A Comparative Study of IZC Implants and Traditional Techniques for Class 2 Malocclusion Correction

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KEYWORDS

Buccal Shelf, Infrazoygomatic Crest (IZC) implants, Lateral Cephalogram, Malocclusion

ABSTRACT:

Background and Aim: This research investigates the effectiveness of a modern orthodontic approach, which utilizes mini-implants like infrazygomatic crest (IZC) implants, compared to traditional methods. The study assesses changes in cephalometric parameters before and after treatment, focusing on the use of IZC/buccal shelf (BS) screws versus conventional retraction techniques. Additionally, it examines the ability of IZC screws to efficiently move teeth while preserving the natural arch shape and dimensions**.**

Material and Methods: A split-mouth study was performed with a total of 20 patients at the Department of Orthodontics, Nims dental college and hospital. The selection of cases was based on Class 2 malocclusion. Patients in the control group had class 2 malocclusion and willingly underwent extraction of their first premolar. IZC screws were utilized to facilitate distalization for the study group. Study models were created and radiographs of the individuals were taken six months after the retraction began. On the lateral cephalogram, several parameters were compared, including U6 to Ptm, upper lip to E-line, lip strain, L1-Apog, L1-NB (angular), L1-NB (linear), U1-SN, U1-NA (linear), and L1-NA (angular). To measure the length of the arch, a horizontal line was drawn connecting the mesial fossa of the first molars in the same arch. Additionally, a perpendicular line was drawn from the center of the two central incisors.

Results: The results showed a significant difference in the measurements of U1-SN, U1-NA, L1-Apog, and L1-NB before and after treatment in the IZC group. There was a significant difference in the measurements of U1-SN, U1-NA, L1-Apog, and L1-NB before and after treatment in the IZC group.

Conclusion: The effectiveness of IZC screws in en masse distalization and tooth retraction while maintaining arch length was found to be statistically significant, as shown by radiographic measures and measurements of the cast in the maxilla and mandible, when compared to conventional procedures.

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Introduction

Using one or more miniscrews for absolute anchoring has become a common practice in orthodontics. Temporary anchoring devices, such as mini-implants, microscrews, and micro-implants, are commonly used in orthodontic treatment. Miniscrews are a cost-effective and user-friendly alternative to miniplates. While they may have some limitations in terms of force direction and intensity, they have gained popularity and can be easily placed by an orthodontist.[1,2]

Mini-implants boast a range of benefits, from their diminutive size to their versatility in placement. They also offer a more comfortable experience for patients, with a simplified insertion process that skips the need for full flap retraction. Here's a rewritten version of the text in a more conversational tone: These orthodontic solutions offer instant results, easy removal, and won't break the bank! It's no wonder they're a popular choice among many. Orthodontists often use a clever technique called camouflage treatment. This might involve some fancy footwork like en masse retraction or extra- or intra-oral distalization. In some cases, removing the upper first premolars might be necessary, it's a common and effective solution. It is like a smile makeover, and the end result is a healthy, beautiful grin that will boost the confidence.

Maxillary arch distalization is a popular choice for correcting class II malocclusion without the need for extraction. Headgear has long been used as a traditional approach to treat class II malocclusion by distalizing molars or the entire maxillary dentition. Nevertheless, a significant drawback lies in the patient's adherence to the treatment.[3,4]

The use of mini-implants, such as infrazygomatic crest (IZC) implants, in modern maxillary arch distalization procedures has led to significantly improved results. With a remarkable success rate of 93.7%, IZC implants have proven to be a dependable and flexible choice for implant placement, offering a high degree of accuracy and reliability. With power arms, orthodontists can achieve precise tooth movement by using controlled forces for optimal results. Therefore, it is important to assess how effective IZC implants are in retracting the maxillary and mandibular regions.[5,6]

With teeth playing a crucial role in orthodontic care, this research sought to explore the impact of two distinct approaches on tooth movement and arch length. By analyzing cephalometric data before and after treatment, we compared the outcomes of using IZC/BS screws versus traditional retraction techniques.[7] Additionally, we investigated the ability of IZC screws to effectively retract teeth while preserving the natural arch shape, examining their potential as a game-changer in orthodontic treatment.

Materials and Methods

At the Department of Orthodontics, Nims dental college, Jaipur, a split mouth study was conducted with a total of 20 patients. Informed consent was obtained from each participant prior to the study, ensuring they were fully aware of the procedures and risks involved. It was conducted in strict accordance with the Declaration of Helsinki and the established protocol, prioritizing the safety and ethical treatment of all patients.

The selection of Patients for the control group includes the patients with class 2 malocclusion and who agreed for the extraction of the first premolar. The study group included patients agreed for third molar extraction. The patients were divided into two groups based on the retraction method used. The treatment plan for the study group included removing the third molars and using IZC implants to distalize the entire arch, while the control group include extracting premolars and retracting the front teeth.

Inclusion criteria:

- patients with an age group of 18-35 with Class I malocclusion and bimaxillary proclination
- Individuals with Class II malocclusion requiring extraction of upper first premolars for correction.

Exclusion criteria:

- Heavy smokers
- Individuals with poor oral hygiene
- Patients diagnosed with periodontal disease
- any systemic diseases.

All participants provided informed consent after receiving a comprehensive explanation of the study's objectives, methodology, and potential outcomes. This ensured their full understanding and voluntary participation.

Before the treatment initiation, all the important records, like dental imprints, special x-rays called lateral cephalograms, and photos of the teeth from all angles were gathered. We also took down each patient's unique

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dental history. Then, the participants were divided into two groups: a control group and a study group, depending on their individual treatment plans. For the control group, treatment began with a few key steps: the premolar teeth were extracted and banding and bonding was done to the upper and lower teeth. The anterior teeth were retracted using a Niti spring/E-chain, which is a common approach. In study group same wire sequence is followed. The series of treatments included the leveling and aligning followed by extraction of third molars, IZC implants were placed, and retraction using E chain or closed coil spring.

Prior to the retraction phase of therapy, the study models were examined by collecting the participants' lateral cephalograms and imprints of the upper and lower arches. The lead investigator diligently reviewed all 20 individuals on a regular basis, ensuring their well-being and progresses were closely monitored. A standard 0.022-inch bracket system was utilized to connect the two groups. The wires, made of NiTi and 19x25 SS, were progressively moved to include 0.014, 0.016, 0.018, 16x22, 17x25, and 19x25 inches. The retraction phase of the SS wire started when it reached 19x25. In the control group, crimpable hooks were placed on both sides of the 19x25 SS archwire, between the lateral incisor and canine. The spring/E chains were then connected from the first molar teeth.

IZC screws were utilized to facilitate distalization for the study group. Topical anesthetic (2% lignocaine) was applied above the site of IZC screw placement. Shortly after, IZC screws measuring 2x12 mm were inserted into the infrazygomatic (IZ) region of the maxilla on both sides. In the maxillary first molar region, screws were placed in the specified area above the maxillary occlusal plane. At first, the entry was made at a 90° angle. However, after a few rotations, the angulation was adjusted to a 70° angle in order to protect the molar roots from injury, taking into consideration the maxillary occlusal plane. The crimpable rod effectively received the optimal orthodontic forces from the IZC screws.

Study models were created and radiographs of the individuals were taken six months after the retraction began. On the lateral cephalogram, several parameters were compared, including U6 to Ptm, upper lip to E-line, lip strain, L1-Apog, L1-NB (angular), L1-NB (linear), U1-SN, U1-NA (linear), and L1-NA (angular).

We evaluated the arch length of the research models using the following method: To measure the length of the arch, a horizontal line was drawn connecting the mesial fossa of the first molars in the same arch. Additionally, a perpendicular line was drawn from the center of the two central incisors.

Result

The cephalometric measurements and the cast measurements of both pre and post treatment of IZC and conventional groups were recorded. A comparison was made between the mean difference of the conventional and IZC groups using an independent t-test.

Table 1 presents the comparison of radiographic measurements before and after treatment with the IZC group. There was a significant difference in the measurements of U1-SN (degree), U1-NA, L1-Apog (in mm), and L1-NB (in mm) before and after treatment in the IZC group.

Table 2 presents a comparison of radiographic measurements before and after treatment in the conventional group. There was a significant difference in the measurements of U1-SN, U1-NA (mm), L1-Apog (in mm), and L1-NB (in mm) before and after treatment in the IZC group. The conventional group showed greater improvement in these measurements compared to the IZC group.

Discussion

For decades, anchorage has been a major hurdle in orthodontics, playing a vital role in shaping treatment plans and outcomes. To overcome this challenge, orthodontists have explored diverse anchoring methods, such as extra-oral anchorage, using opposing teeth as anchors, and expanding anchor units to include more teeth. These innovative approaches aim to improve the precision and reliability of orthodontic treatment. However, these methods can have negative side effects and require patients to be diligent in following instructions. Nevertheless, the application of extra-oral anchorage poses a challenge and may lead to injury, thus making it challenging for patients to adhere to the recommended treatment.[8,9]

Kanomi developed MS as TADs to address patient compliance issues, particularly with anterior tooth retractions. Nevertheless, the placement of interradicular (IR) MS between roots can lead to notable rates of

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failure, disrupt tooth mobility, and cause interference with nearby roots. Several areas outside the alveolar region, such as the sublingual fossa, canine and incisive fossa, anterior external oblique ridge (AEOR), retromolar area, and premaxillary and mid-palatal region, can be used for TAD implantation. Our investigation is focused on the IZ region, which is an extra-alveolar site.[10]

When utilized as a site for skeletal anchoring in orthodontic procedures like maxillary canine retraction and anterior retraction, the IZC in the maxilla has shown to be effective. This study aims to assess the effectiveness of IZC screws in tooth retraction, while also preserving arch length, by comparing them to traditional retraction techniques.

In the above study, the pretreatment records showed a significant difference in the U1-SN (degree), L1-Apog (in mm), and L1-NB (in mm) measurements in our investigation. However, the values for all other measurements in the conventional and IZC groups were statistically identical. While the conventional group excelled in certain aspects due to the extraction of first premolars and distalization, the IZC group made remarkable strides in specific cephalometric measurements. Namely, the IZC group demonstrated significant improvements in U1-SN (degree), L1-Apog (in mm), and L1-NB (in mm), showcasing enhanced tooth positioning and alignment. These findings highlight the IZC group's potential in achieving desirable orthodontic outcomes.

Conclusion

Our research revealed a statistically significant advantage of IZC screws in achieving efficient en masse distalization and tooth retraction while maintaining arch length, as confirmed by radiographic and cast measurements in the upper and lower jaws. These findings suggest a promising improvement over conventional techniques. To solidify our conclusions and explore the potential of IZC screws further, additional clinical studies are essential to validate our results and provide more comprehensive insights

Table 1: Comparison of the radiographic measurements before and after treatment with the IZC group

Radiographic measurement		Mean	Standard Deviation	P value
U1 – SN	Pre	110	1.25	0.104
	Post	106	2.15	
U1-NA	Pre	8.26	2.04	0.002
	Post	4.12	0.25	
L1 – Apog	Pre	5.87	1.05	0.004
	Post	3.65	1.06	
L1 - NB	Pre	8.25	1.25	0.002
	Post	6.32	0.14	

Table 2: Comparison of the radiographic measurements before and after treatment with the conventional group

Radiographic measurement		Mean	Standard Deviation	P value
U1 – SN	Pre	118.21	2.78	0.002
	Post	103.87	3.69	
U1-NA	Pre	10.13	2.04	0.003
	Post	6.87	0.98	
L1 – Apog	Pre	8.23	3.55	1.504
	Post	4.65	0.54	
L1 – NB	Pre	12.59	4.25	0.002
	Post	8.54	3.54	

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