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Massive maxillary molars intrusion using indirect anchorage on TADs, case report

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Abstract. This study presents a comprehensive review of case focusing on the intrusion of maxillary molars in individual necessitating prosthetic rehabilitation, incorporating a tailored treatment approach. Addressing the unique challenge of providing treatment without direct orthodontic supervision, especially during extended periods such as the COVID-19 lockdown or for patients residing abroad, is a significant aspect. Furthermore, the study acknowledges the added complexity when the treatment timeframe may coincides with the osteointegration process of dental implants.

Using orthodontic miniscrew indirect anchorage, the study demonstrates the effectiveness of maxillary molars intrusion in solving various dental concerns, including restoring posterior occlusion and achieving occlusal clearance for prosthetic rehabilitation. Through the presentation of successful outcome in patient with overeruption and occlusal interference, the study highlights the simplified orthodontic procedures, preservation of tooth enamel, and maintenance of periodontal health achieved with this approach.

Moreover, the study emphasizes the complementary role of mandibular molars space rehabilitation with dental implant prostheses in enhancing masticatory function and overall oral health, thus underlining the significance of skeletal anchorage systems in achieving predictable and stable results in complex dental cases.

In conclusion, this study underscores the importance of interdisciplinary collaboration and innovative treatment approaches in addressing the challenges associated with maxillary molar intrusion for prosthetic rehabilitation. By incorporating personalized treatment strategies and utilizing orthodontic miniscrew indirect anchorage, the study provides valuable insights into achieving optimal outcomes and patient satisfaction in complex dental cases.

Key words: Maxillary molar intrusion, posterior occlusal rehabilitation, miniscrew, indirect anchorage, digital planning, intrusion plate

Introduction

Prosthetic rehabilitation constitutes a multifaceted process involving various dental specialists [1]. The loss of a posterior teeth, whether due to caries, periodontal disease, or trauma, poses challenges as it can lead to occlusal alterations, including overeruption of opposing teeth and migration of adjacent teeth [2, 3]. To accommodate a prosthesis adequately, both mesiodistal and vertical space must be addressed, often necessitating collaboration between prosthodontists and orthodontists [4, 5].

However, rectifying extruded teeth, particularly in adult patients, presents complexities, given their reduced responsiveness to orthodontic forces attributed to histological and biological changes in the bone [6, 7]. While simple grinding can address some cases of insufficient vertical space, more complicated scenarios may require endodontic intervention and prosthetic crown reshaping, which are invasive and costly [8, 9].

Intrusion by an orthodontist offers an alternative approach to maintain clinical crown integrity and tooth vitality, especially in cases requiring space reopening in

edentulous areas [10]. However, successful orthodontic treatment relies on careful consideration of various factors, including periodontal health, required intrusion magnitude, bone availability, and adjacent tooth condition [1, 4, 10].

Traditionally, orthodontic treatment involved extensive appliances to ensure adequate dental anchorage, particularly challenging when multiple teeth need intrusion or when terminal teeth are involved [11, 12]. Fortunately, the advent of orthodontic miniscrews, or temporary anchorage devices (TADs), has revolutionized orthodontic practice. TADs minimize reliance on dental anchorage, mitigate adverse effects on adjacent teeth, and offer more efficient force application for intrusion [13]. Additionally, they are safe, cost-effective, minimally invasive, and versatile, enhancing treatment outcomes and patient acceptance, especially among adults [13, 14].

Biomechanically, during intrusion of molars on maxilla we have to apply forces from both side, buccal and palatal, in another case some side effects, like tipping, could happen. To prevent palatal tipping transpalatal arch may be used. Options included miniscrew at infra zygomatic crest or alveolar crest and miniplates may be chosen to establish anchorage from the vestibular side, but they could have some disadvantages like high risk of movable mucosa irritation leading to inflammation and failure [18,19], or bone exposure for installation and deinstallation of miniplates, that requires surgical flap twice [20,22]. Now we can think that miniscrew placed between the roots much better choice than previous, but there are a few disadvantages that we have to consider before placement:

- insufficient space on the buccal side often poses implant insertion challenges [23-25] and lead to thinner implants body has to be chosen that is a higher risk of failure [19,27,28] caused by fracture [26];
- small distance between roots complicates the insertion of a miniscrew and may result in accidental damages of periodontal structures and dental root possibly causing failure; [29,30]
- inserting miniscrew for molar intrusion means high position in distal area that often have some risk of maxillary sinus penetration; [31]
- palatal side often has thick soft tissue, that lead to increasing of lever arms and probability of miniscrew tipping; [27,32]
- molar movement against a miniscrew, may result in a failure with a root surface damage; [33,34]

To address these issues, it is preferable to place miniscrew away from intended teeth for movement such as anterior palate or «T-zone» with suitable bone quality, thin soft tissues and no dental interference or root damage risks allowing larger miniscrew placement with greater stability. [35,36]

Therefore, the case report orthodontic approach used to intrude teeth 2.6, 2.7 as first stage treatment (intrusion of teeth 2.4, 2.5 and improvement of the alignment in both arches were planned as a second stage). Appliance were used as indirect anchorage of miniscrews inserted on palate and vestibular alveolar crest between 2.4, 2.5, to get required intrusion for adequate prosthetic restoration on dental implants replacing teeth 3.6, 3,7.

Case history

Patient, 26 year old, was referred by general dentist. Chief problem is overerupted maxillary left first and second molars. Over eruption was, as the result of missing crown bridge on the lower left side (teeth 3.4, 3.5 - 3.8) for a long period. Task were in intrusion of molars in preparation for prosthetic rehabilitation after placement of a dental implant in lower left region (Fig. 1).

Clearence that was present between upper molars and mandibular soft tissue was just 2.5-3 mm. When the desirable interocclusal space over a dental implant recommended to be minimum 5-8 mm [15]. To regain interocclusal clearance in such situations, endodontic treatment with subsequent crown reduction not the best choice, especially then we talk about sound teeth. The use of orthodontic miniscrew for molar intrusion looks much better solution.

To get the goal decision was taken to use two miniscrew (2x9 mm, PSM Medical Solutions, Tuttlingen, Germany), as indirect anchorage for an orthodontic Mousetrap appliance [16]. Later on, after one month, appliance has been changed to intrusion custom plate, as original appliance often cause painful irritation for the tongue of the patient

Third miniscrew, also, was added (between the roots of 2.4, 2.5) for better stability and rigidity of the appliance. Wisdom teeth were scheduled for extraction. The patient has intention solve her malocclusion, as the second stage of treatment as she also has lost teeth 1.6, 4.6 and opening space for rehabilitation is required.

Appliance placement

As preparation for installation of two miniscrews (2x9 mm, PSM Medical Solutions, Tuttlingen, Germany) application of topical and local anesthesia was performed, next step is a predrill to a depth of about 3 mm by a 1.4 mm-diameter drill using an implant motor unit. insertion vector has to be oriented perpendicular to the palatal curvature. The placement of miniscrew and Mousetrap

appliance was performed in a single appointment, facilitated by digital planning using OnyxCeph™ dental software (Image Instruments, Chemnitz, Germany). Additionally, a printed surgical guide was employed to ensure precise execution of the treatment plan. Molar bands were placed on teeth 2.6 and 1.7.

A metal plate with a soldered.032» stainless steel wire was bended to be passive to palate and fix to the miniscrews. A TPA with a soldered additional hook for attachment of the lever arm was placed, and an intrusive force of about 100g per tooth [16] was activated. (Fig. 2). The miniscrew head has an inner screw thread for fixation of various abutments.[17] That is a great benefit of this type of TADs, given the opportunity to keep the same miniscrew and design new appliance in the same

Korea) was installed between roots of 2.4, 2.5.for better anchorage and stability of appliance. As a main force for intrusion were used Ni-Ti closed coil springs, but it can be replaced by power chain, that is require more often check ups.

In eight months, the teeth had been intruded approximately 5 mm to the desired level (Fig. 3,4). Dental implants for replacing 3.6,3.7 were inserted in the lower jaw during orthodontic treatment, therefore everything was ready for prosthodontic rehabilitation.

Discusion

Molar intrusion stands as a vital aspect of orthodontic treatment, often necessary for correcting various malocclusions and attaining optimal occlusal

Figure 1. Lateral view before treatment, photo was done just
Source: compiled by the authors

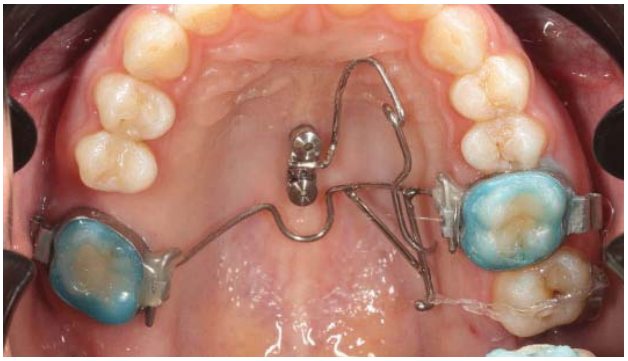

Figure 2. The Mousetrap appliance is installed, with the Beneplate's .032» stainless steel wire bent and fixed to a hook soldered onto the Transpalatal Arch (TPA).
Source: compiled by the authors

Figure 3a. Custom intrusion plate attached ro miniscrews.
Source: compiled by the authors

Figure 3b. Lateral view after 8 month of intrusion
Source: compiled by the authors

software. Custom intrusion plate has been fabricated after one month from the beginning of treatment, as we have to replace the original appliance due to painful irritation for the tongue. Third mini screw with a long polished neck (OSSH16064, Osstem Implant, Busan,

and aesthetic results. Traditionally, achieving molar intrusion involved complex orthodontic methods, which sometimes led to undesired effects like loss of anchorage and prolonged treatment periods. However, the advent of miniscrew-supported molar intrusion presents a

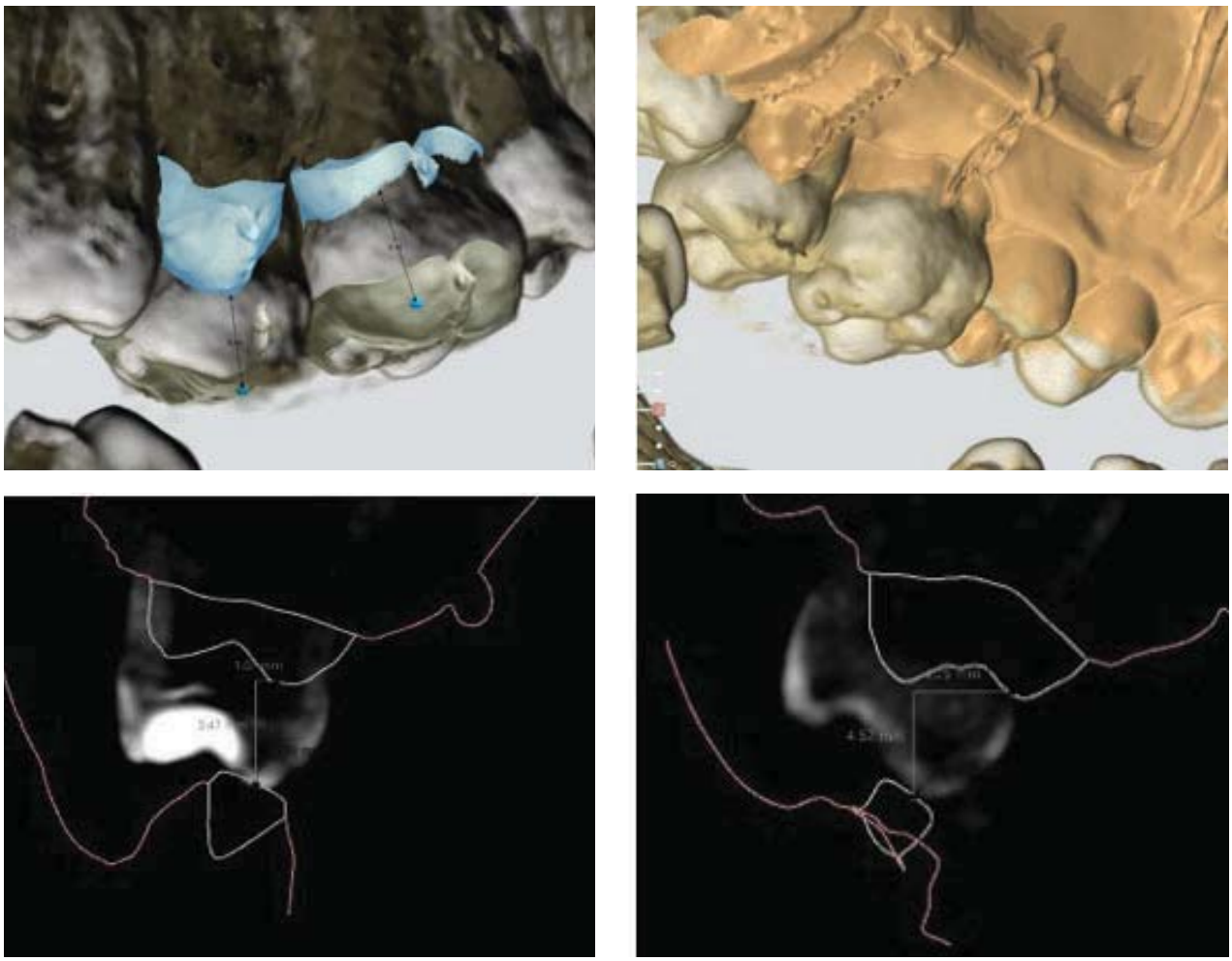

Figure.4: Superimposition after intrusion shows total intrusion for 5 mm (Evaluation of the intrusion was done by superimposition and measuring the dentitions with Ortho Analyzer software (3Shape, Copenhagen, Denmark)
Source: compiled by the authors

promising alternative, offering enhanced control and predictability in orthodontic procedures.

The outcomes of this case report the effectiveness of miniscrew-supported molar intrusion in achieving the desired amount of intrusion, with a notable intrusion of 5 mm. This highlights the practicality of miniscrews as reliable anchorage devices for precise molar intrusion, aligning with previous research emphasizing their accuracy and reliability. [37]

Furthermore, miniscrew-supported molar intrusion demonstrated efficiency in treatment duration, with the desired intrusion achieved within a relatively short 8-month period. This efficiency can be attributed to the improved control afforded by mini-screw anchorage, allowing orthodontists to expedite intrusion while minimizing unwanted tooth movements. This finding resonates with studies emphasizing the time-saving benefits of miniscrew-supported orthodontic techniques.[38]

A noteworthy aspect of this case was the minimal occurrence of complications associated with miniscrew-supported molar intrusion. The reported minor complications, such as mucosal irritation and discomfort, were effectively managed, reflecting the safety and feasibility of this approach. These results align with existing literature, which generally reports low complication rates linked to mini-screw usage in orthodontic procedures.[32,34]

Overall, the findings of this case report hold practical implications for orthodontic practice. Miniscrew-supported molar intrusion provides orthodontists with a valuable tool for achieving controlled and efficient intrusion with minimal complications. The ability to streamline treatment while ensuring stability and precision can lead to improved patient experiences and overall treatment outcomes. Incorporating miniscrew-

supported intrusion plate mechanics into treatment plans for cases necessitating molar intrusion may be considered by orthodontists seeking to optimize treatment efficacy and patient satisfaction.

Conclusion

The intrusion plate proves to be a reliable device for the intrusion of overerupted molars. Despite its somewhat bulky design, it has been simpler compared to other temporary anchorage device based appliances. The plate offers the ability to create consistent force delivery, particularly when using nickel-titanium (Ni-Ti) closed coil springs, which is easy to measure and adjust intraorally. With its primary anchorage in the palate "T-zone" , the intrusion plate ensures a low risk of failure or screw fracture, enhancing its reliability and effectiveness in clinical applications.

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Conflict of Interest

The authors assert that there are no conflicts of interest pertaining to the publication of this case report. They affirm that they have no financial affiliations or personal relationships that might potentially influence their impartiality in presenting the study's outcomes or interpretations. Furthermore, there are no competing interests, such as employment engagements, consultancies, equity ownership, or receipt of honoraria, that could introduce bias into the research or its conclusions. This explicit declaration underscores the commitment to transparency and integrity in the dissemination of the study's findings.

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Масивна інтрузія молярів верхньої щелепи із використанням непрямої опори на мікроімплантах. Звіт про випадок

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Резюме. Це дослідження представляє всебічний огляд клінічного випадку з потребою інтрузії молярів верхньої щелепи у пацієнта, який потребує протезування, інтегруючи індивідуальний підхід до лікування. Вирішення унікального завдання проведення лікування без безпосереднього ортодонтичного нагляду, особливо під час тривалих періодів, таких як карантин COVID-19 чи в лікуванні пацієнтів, які проживають за кордоном, є важливим аспектом. Крім того, дослідження визнає додаткову складність, коли терміни лікування можуть збігатися з процесом остеоінтеграції зубних імплантатів.

З використанням непрямої опори на ортодонтичні мікроімпланти, дослідження демонструє ефективність інтрузії верхніх молярів для розв'язання стоматологічних проблем, включаючи відновлення оклюзійної площини та досягнення оклюзійного простору для протезування. Через презентацію успішного результату лікування у пацієнта з вторинними деформаціями у вигляді значної екструзії та наявністю інтерференцій в прикусі, дослідження освітлює спрощені ортодонтичні процедури, зі збереженням твердих тканин зубів та підтриманням пародонтального здоров'я.

Крім того, дослідження акцентує на ролі реабілітації простору молярів нижньої щелепи з подальшою можливістю протезування на зубних імплантатах для покращення жувальної функції та загального здоров'я порожнини рота, підкреслюючи важливість систем скелетного анкоражу для досягнення передбачуваних та стійких результатів у складних стоматологічних випадках.

Висновок: це дослідження підкреслює важливість міждисциплінарної співпраці та інноваційних підходів до розв'язання проблем, пов'язаних з інтрузією верхніх молярів для протезної реабілітації. Шляхом впровадження індивідуальних стратегій лікування та використання непрямої опори на ортодонтичні мікроімпланти, дослідження дає цінну інформацію про досягнення оптимальних результатів і задоволеності пацієнтів у складних стоматологічних випадках.

Ключові слова: інтрузія верхнього моляра, постоклюзійна реабілітація, мінігвинт, непрямий анкерний пристрій, цифрове планування, інтрузійна пластина.

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