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Expanding the Scope of Envelop of Discrepancy with TAD: A Review

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ABSTRACT

Successful anchorage management is important to achieve optimum treatment outcome in orthodontics. To preserve anchorage as stated by Graber, as per Newton's third law; any force applied during orthodontic treatment may lead to anchorage loss in posterior segment which is not beneficial in severe dental malocclusions. Orthodontists have conventionally used devices like headgears, transpalatal and lingual arches to prevent anchor loss which are proved to be unstable, needs complicated wire bending and affects aesthetics which in turn requires patient's cooperation. To overcome these problems and to preserve the anchorage to the fullest, there comes the role of Temporary Anchorage Device (TAD).

Key words: Temporary anchorage device, Skeletal anchorage, Mini screw, Orthodontic treatment, Dental malocclusions

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INTRODUCTION

Anchorage is the resistance to undesirable tooth movement during orthodontic treatment. This can be offered by intra-oral anchor points such as the teeth and palate, as well as extra oral devices such as headgear. Unfortunately, all of these traditional approaches share a major flaw *i.e.* they all rely on patient cooperation to be effective [1]. Every orthodontist's ambition has been to have stationary anchoring without any loss of extra space. Recent research suggests that the introduction of mini screw, also known as Temporary Anchoring Devices (TADs), an American term [2], has ushered in a new era of orthodontic success.

The idea of discrepancy was created by Profit and Ackerman to graphically depict how much change may be achieved by different sorts of treatments. The inner circle which is also known as envelop, portrays the drawbacks of camouflage treatment involving only orthodontics; on the other hand the middle envelop represents the limits of combined orthodontic treatment and growth modification; and outer envelope illustrates the limits of surgical correction. This envelop has certain limitation as it is defined by its own boundaries one cannot treat the extreme malocclusion by trespassing. Here, comes the role of TADs. As TADs provide extreme range of the movements [3] dimensionally and help us to treat severe malocclusion needing surgical correction into non-surgical.

LITERATURE REVIEW

In this following review article, we will be discussing how the TADs have widened the purview of envelop of discrepancy for the ease of orthodontist and the benefit of patient.

Need for invent of tads: The importance of orthodontic anchoring in achieving optimal treatment outcomes cannot be overstated. With increasing advancements in the field of orthodontics, TADs have made a huge difference in the treatment outcomes. It has helped in treating extraction cases into non extraction cases, surgical cases into a non-surgical one, and many more. Whole segment of teeth can be distalized for treatment with the help of retro molar, tuberosity and palatal or on plant mini screw placement. In this way, it expands the scope of envelop of discrepancy with temporary anchorage devices. Stable anchoring is necessary for orthodontic treatment using fixed equipment. When skeletal anchoring implants are utilised, a tooth can be moved without making use of any headgear or intraoral elastics. Temporary anchorage devices have been commonly used in orthodontic treatment to widen the tooth movement boundaries without the consent of the patient [3-6]. Temporary anchorage device skeletal anchoring is very useful for treating vertical malocclusions, such as tooth over eruption caused by antagonist loss and open bite [7-12]. To reduce maxillary dento alveolar height, skeletal open bites have usually

required substantial surgical impaction before TAD skeletal anchoring became extensively employed; super erupted teeth were customarily treated with endodontic surgery and crown rehabilitation at the expense of tooth life. Before TAD skeletal anchoring became extensively employed, super erupted teeth were customarily treated with endodontic surgery and crown rehabilitation at the expense of tooth life.

TAD skeletal anchoring is efficient for sagittal dental movement, such as distalizing or mesializing the whole dentition, with or without extraction [6,13]. With the exception of malocclusions accompanied by facial deformities, TAD skeletal anchoring can correct all forms of malocclusions., which need invasive and lengthy procedures to produce a harmonic skeletal connection [13,14]. Many types of TAD shave been used in orthodontics [15,16]. Turley, et al. and Roberts, et al. [17] both reported on traditional osseointegrated implants. Palatal implants were reported by Wehrbein, et al. however mini- and micro implants were described by Costa, et al. and Freudenthaler, et al. The goal of this research is to look at the clinical use, development, advantages, and disadvantages of miniscrew and plate type implants, which are used to offer a temporary but permanent skeletal anchoring for orthodontic reasons.

Types of tads available: Skeletal anchoring devices may be divided into two groups based on their origin. The orthodontic mini-implants, retro molar implants, and palatal implants fall under the first group of osseo integrated dental implants. Surgical mini implants, for instance those employed by Creek more and Eklund, Kanomi, and Costa, et al., fall into the second group. Surgical mini-implants are smaller than regular implants, have smooth surface, and may be loaded immediately after insertion. They can also be classified as biocompatible or biologic. Dilacerated teeth and ankylosed teeth were included in the biologic group, whereas TADs were included in the biocompatible group. He then divided both groupings into biochemical (osseointegrated) and mechanical subgroups depending on how they adhere to bone.

Labanauskaite, et al. suggested the classification according to following:

- Size and shape
    - Conical (cylindrical)-miniscrew implants-Palatal implants
    - Miniplate implants
    - Disk implants (onplants)
- Placement
    - Buccal
    - Palate
    - Intrazygomatic
    - Retromolar
    - Tuberosity
    - Anterior nasal spine

Indications of TADs

Treating extraction cases into non-extraction cases with temporary anchorage devices: In order to treat a severe malocclusion without extraction, the maxillary dentition and the mandibular dentition. To distalize the maxillary molars, many devices have been designed and employed. Almost all appliances, on the other hand, necessitate patient cooperation and have negative reciprocal effects. TADs were used for orthodontic anchoring, and they're a flexible alternative for the practitioner. When compared to endosseous alternatives, they are less expensive, and the possibility of early loading following installation reduces treatment time. As an absolute anchoring, they can also provide distinct benefits to non-extraction treatment. They can minimise unwanted reciprocal movement and enhance treatment efficiency because to their ability to retract whole dentitions. Minor Class III malocclusions can be concealed by distalization of the mandibular dentition and a range of additional treatment methods. For the most part, inter maxillary elastics with fixed appliances have been employed [19]. However, Class III elastic wear has unfavourable side effects such as maxillary molar and mandibular incisor elongation, maxillary incisor proclination, and it also widens maxillary molars and causes them to roll their crowns lingually, in addition to demanding patient compliance [20]. Absolute anchorage systems have been used for either molar distalizationen-masse distalization of the mandibular dentition or [21-28] to avoid these undesirable effects. This was accomplished with the use of a mini screw assisted mandibular molar distalization.

Treating surgical cases into non-surgical cases with temporary anchorage devices: A frequent malocclusion that affects people of all ages, from childhood to maturity, is maxillary transverse deficiency. If not treated quickly, it can deteriorate and evolve into a more severe malocclusion, inhibiting facial growth and development. More recently, investigations have demonstrated that anchoring micro implants may be used to increase the maxilla in grown patients without the need for osteotomies. This innovative method is called Micro implant-Assisted Rapid Palatal Expansion (MARPE). Adults with skeletal anterior open bite malocclusion face one of the challenging forms of malocclusions that an orthodontist may encounter. TADs have been proven to be an effective treatment for this form of malocclusion, obviating the need for surgery or extra oral appliances. In the past, Le Fort I maxillary impaction was the sole option to repair a gummy grin in adults. Another option for correcting a gummy smile is to intrude the upper anterior using anterior sub apical mini-implant anchorage [29-34].

Distal or mesial shift of teeth with maximum anchorage: It is difficult to shift teeth of posterior region towards mesial sides; there is no anchoring from the anterior region. Generally, orthodontist decides to shift the remaining posterior teeth to the mesial direction, when a first primary molar is removed and successor first permanent bicuspid is missing, to cover the gap left

by the primary first molar. This occasionally causes trouble as the teeth of anterior region tend to move in posterior (distal) direction, making the incisors to stand erect and shifting the location of canine to Class II. In order to preserve the position of the anterior segment teeth, along with the Class I canine, skeletal anchoring can be utilized to provide either indirect anchorage with a firm link to the anterior segment or direct anchorage with an active attachment to the molar segment. Without losing the canine's position or affecting the incisors' overbite-over jet relationship, the gap can be closed more effectively with the posterior molars. A variety of dental movements, including distalizing the maxillary teeth, can be used to enhance a Class II connection. Maxillary molars can be moved distally to create space minimising the over jet, and achieving canine Class I connection. If the patient comes with Class III condition, the orthodontic practitioner may opt to counterbalance by maximising the anchorage of the mandibular posterior teeth or by distalizing the mandibular molars. This permits mandibular anterior teeth to retract and closes the hole while still providing the teeth's distal segment with optimal anchorage. Because the posterior teeth are likely to migrate towards the mesial when using conventional mechanics, this may be difficult to accomplish without skeletal support. As a result, these treatments might be effective if the orthodontist wants to seal the area with the most anchoring in either segment after bicuspidectomy. Although traditional orthodontic mechanics can easily accomplish this, skeletal anchoring appliances can be used to improve efficiency in select cases when the anchorage is deficient or larger amount of anchorage is desirable.

Intruding or up righting molar teeth for correction of deep bite and as a space regainer: Up righting a posterior tooth that has slipped mesially in the space which is edentulous is one of the tedious tasks in the field of orthodontics. This is common in people those who have lost their first molar due to caries exposure and had their second molar tooth tilted to mesial side over the passage of time. If the patient gets orthodontic treatment after this incident, it may become hard to straighten second molar without the need of extruding the teeth and broadening the bite of patient. The tooth can be straightened using a skeletal anchorage without the unfavourable extrusion that is frequent with traditional orthodontic procedures. An overerupted upper or lower tooth in an improper location due to an edentulous gap in the contralateral arch is another tough condition to repair. In this situation, using traditional orthodontic methods to repair encroaching teeth is challenging. When a skeletal anchoring device is applied, intrusion is a fairly easy orthodontic action. This procedure can be used on either the posterior or anterior teeth. In patients with deep class II relation and significant overbite, the front maxillary teeth can be retro positioned and intruded to resolve the over jet-overbite link. An incursion arch or other traditional methods, such as headgears, are commonly utilised to do this. This is far more efficient using bone anchoring devices, and moreover it requires very little involvement of patient.

Closure of anterior open bite with posterior intrusion and mandibular plane corrector: The first report of anterior open bite correction using orthodontic anchoring devices generated a lot of buzz. To achieve this, orthodontic screws or plates are frequently placed in the posterior maxilla, apical to the teeth. For the closure of anterior open bite, the posterior molars &premolars are intruded (if necessary). In a number of case studies, this has been demonstrated to be useful. The difficulty of correcting the front open bite with orthodontics alone, as well as the frequent recurrence, has piqued interest in this field. Orthognathic repositioning is a treatment approach that is supposed to improve stability. Although case reports and a few case series articles have demonstrated that skeletal anchoring to seal an anterior open bite is stable, there is no long term data on the procedure's stability as there is for orthognathic surgery. As a result, the authors propose this procedure for patients who are unable or unable to undergo orthognathic surgery, as well as those with restricted open bites. Individuals with open bites who have ended in failure of orthodontic treatment may be the candidates for this approach, albeit retreatment has additional risks, including as root resorption. Extruding the anterior maxillary teeth should be avoided by orthodontists since it will compromise the correction's long-term stability. When it comes to long-term goals, patients should be advised to tread carefully.

DISCUSSION

Anchorage is the resistance to undesirable tooth movement during orthodontic treatment. This can be offered by intra-oral anchor points such as the teeth and palate, as well as extra oral devices such as headgear. Unfortunately, all of these traditional approaches share a major flaw *i.e.* they all rely on patient cooperation to be effective [1]. Every orthodontist's ambition has been to have stationary anchoring without any loss of extra space. Recent research suggests that the introduction of Miniscrew, also known as Temporary Anchoring Devices (TADs), an American term [2], has ushered in a new era of orthodontic success.

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In the following review article, we have discussed how the TADs have widened the purview of envelop of

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CONCLUSION

Previously the orthodontic movements that were regarded to be difficult and that should be addressed within the limitations of the envelop of discrepancy are now attainable due to bone anchoring devices. These device does not speed up movement of tooth, but they provide with the most bone-borne anchoring, resulting in more effective mechanics for movement of teeth while limiting undue reciprocal tooth movement in the range of clinical conditions. Unwanted reciprocal movements of tooth are likewise minimised/eliminated. Another benefit is the use of mechanics that do not rely on patient compliance. TADs have enhanced the efficiency of therapeutic results. It has made it possible to treat patients more effectively. Maxillary tooth movement, such as molar distalization and incisor retraction, can be accomplished with TADs. TADs can also be utilised to perform molar incursion, and TADs can be used to address surgical problems without the need for surgery. As a result, temporary anchorage devices are expanding the envelope of discrepancy.

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