

## Temporary Anchorage Device-Clinical Applications-Review

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### Review Article

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**Abstract:** Traditionally, orthodontists have used teeth, intraoral appliances, and extraoral appliances, to control anchorage—minimizing the movement of certain teeth, while completing the desired movement of other teeth. In the past 5 years, the orthodontic literature has published numerous case reports documenting the possibility of using several different types of temporarily placed anchorage devices in approximation to bone with the intent of enhancing or overcoming the limitations of traditional anchorage [1]. This article is intended to review the clinical applications of temporary anchorage devices

**Keywords:** Temporary anchorage devices, clinical applications, review.

### INTRODUCTION

Traditionally, orthodontists have used teeth, intraoral appliances, and extraoral appliances, to control anchorage—minimizing the movement of certain teeth, while completing the desired movement of other teeth. In the past 5 years, the orthodontic literature has published numerous case reports documenting the possibility of using several different types of temporarily placed anchorage devices in approximation to bone with the intent of enhancing or overcoming the limitations of traditional anchorage [1].

### Temporary anchorage devices

A temporary anchorage device (TAD) is a device that is temporarily fixed to bone for the purpose of enhancing orthodontic anchorage either by supporting the teeth of the reactive unit or by obviating the need for the reactive unit altogether, and which is subsequently removed after use.

They can be located transosteally, subperiosteally, or endosteally; and they can be fixed to bone either mechanically (cortically stabilized) or biochemically (osseointegrated).

Importantly, the incorporation of dental implants and TADs into orthodontic treatment made possible infinite anchorage, which has been defined in terms of implants as showing no movement (zero anchorage loss) as a consequence of reaction forces [2].

### History of temporary anchorage device

In the late 1950s that Per Ingvar Brånemark [4] was using specially designed optical titanium chambers to study the intravascular dynamics of bone marrow circulation by transillumination in vivo. At this point in time, the titanium chambers were custom made and extremely expensive, therefore they were to be removed and reused. However, bone grew into the thin spaces in the titanium and could not be easily removed. It was

this finding that prompted the detailed experimentation that ensued. Based on these and other findings by the Brånemark's group [3-5] he advocated a healing time of 4 to 6 months before functional loading because function allowed micromotion, which permitted fibrous tissue growth and subsequent failure.

Although the concept of temporary implant anchorage has only recently been described, it was envisioned as early as 1945. The first clinical report in the literature of the use of TADs appeared in 1983 when Creekmore and Eklund<sup>6</sup> used a vitallium bone screw to treat a patient with a deep impinging overbite. The screw was inserted in the anterior nasal spine to intrude and root and correct the upper incisors using an elastic from the screw to the incisors 10 days after the screw was placed.

## TEMPORARY ANCHORAGE DEVICE

The currently available temporary anchorage devices can be classified as either biocompatible [7] or biological in nature. Both groups can be subclassified based on the manner in which they are attached to bone, either biochemical (osseointegrated) or mechanical.

Characteristics of an ideal anchorage device

- Simple to use
- Inexpensive,
- Immediately loadable,
- Small dimensions,
- Can withstand orthodontic forces,
- Immobile,
- Does not require compliance,
- Biocompatible, and
- Provides clinically equivalent or superior results when compared with traditional anchorage systems.
- “miniscrew implant” will be defined as having a diameter of less than 2.5 mm

## Loading of implants-variable concepts

Based on both clinical and experimental evidence, felt that premature loading caused micromotion of the implants, which allowed the invasion of fibrous tissue, and implant failure. The findings of Tarnow and colleagues [8] suggested that immediate loading of implants may also be possible clinically as long as the implants are splinted together, thereby minimizing local micromotion

Duyck’s group [9] recently evaluated the differences in load type on osseointegrated implants. After 10-mm-long Brånemark implants were allowed to heal for 6 weeks, the implants were loaded for 14 days either statically (constant loads of uniform force levels), dynamically (cyclic loads of variable force levels), or left unloaded. Interestingly, similar bone: implant contact was seen for all implants, but a difference was seen in the marginal bone around the implant. The statically loaded and unloaded controls showed a more dense cortical lamellar bone at the neck and apex of the implants, whereas the dynamically loaded implants revealed bony craters and Howship’s lacunae around the implants necks, indicating a higher level of bony resorption. Gotfredsen and colleagues [10] found similar results in laterally loaded experimental implants—higher bone density and bone:implant contact for the statically loaded implant compared with unloaded controls.

Implants designed for mechanical retention (and not osseointegration) can also be loaded earlier. Since the more stable osseointegrated implants require static loading, it can be assumed that mechanically retained implants must also be statically loaded. The individual TADs should be at least 1.5 mm in diameter

and gingival inflammation should be addressed with appropriate measures as soon as possible.

The factors statistically associated with decreased success were 1) an increased mandibular plane angle, 2) increased gingival inflammation, and 3) decreased screw diameter. Surprisingly, screw length was not negatively associated with success

## CLINICAL APPLICATION

### Anterior Retraction

Retraction of the anterior teeth with TADs can be performed in two general ways. In the first, called indirect anchorage, the traditional teeth comprising the anchorage or reactive unit are tied to the TAD; that is, the unit to be moved is not attached directly to the TAD. With this approach, traditional orthodontic biomechanics may be utilized without anchorage loss. The second approach is called direct anchorage. In this case, the active unit is attached to the TAD and bypasses anchorage to the other teeth. When using this method, clinicians must exercise great caution with regards to biomechanical principles

### Protraction of Posterior Teeth

One of the promising uses of TADs for protraction occurs when a primary second molar is lost and there is no second bicuspid to replace it.

### Molar or Posterior Arch Intrusion

It is often necessary to intrude hyper-erupted unopposed teeth in an opposing arch. Often, teeth can be restored to an appropriate occlusal plane without reduction in crown height or endodontic therapy prior to placing a bridge or implant in the opposing arch. It is also a useful procedure in correcting occlusal cants and as well as intrusion of posterior teeth for open-bite correction

Molar Distalization for Class II Correction: the use of a palatal TAD(s) attached to a transpalatal arch that is bonded to the second or first bicuspid. The palatal approach has become more popular due to the excellent bone stock found in the parasagittal area in the bicuspid region.

### Anterior Intrusion for Deep Bite Correction

These devices are very useful (using either a direct anchorage or an indirect anchorage) for intrusion of anterior teeth for correction of a deep overbite. This is particularly helpful in patients with excessive gingival display and maxillary incisor display with the lips in repose. Typically, TADs can be used with direct anchorage to the maxillary incisor segment, or an indirect anchorage can be utilized when an intrusion auxiliary arch is utilized for incisor intrusion.

## CONCLUSION

Since the advent of tad in the field of orthodontics, anchorage planning is simplified. a number

of clinical uses have reduced the chairside time in extra care in fabrication of specialized arch wire forms. borer line cases are best managed with the help of temporary anchorage devices. invention of tad is one of the best in the field since past decades.

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