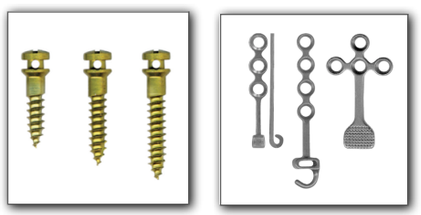
Classification of Anchorage Devices

Ludwig et al suggest five types of devices can be used for **absolute anchorage**:

-Ankylosed tooth
-Endosseous Implant
-Palatal Implant
-Mini-Screw
-Mini-Plate

A special class of anchorage devices are **Temporary anchorage devices (TADs),** which should maintain the following characteristics:

-Can be immediately loaded (do not require osseointegration).
-Are used for short periods of time.
-Are relatively easy to place and remove.
-Do not require patient compliance.



Taken from KLS Martin

This leaves mini-screws and mini-plates pictured above as ideal TADs. At the moment, there is continuing research to develop more predictable TADs to achieve ideal tooth position more rapidly, and to incorporate these devices into daily orthodontic practice.

References

IJOMS. Tsui et al. 2012.
Int Orthod. Thebault et al. 2011.
OMSCNA. Costello et al. 2010.
COIR. Shatzles et al 2009.
Sem in Orthod Crismani et al 2005.

complete references available on request

Newton's Third Law

The idea that teeth can be moved through bone into a more favorable position has been in use since the 18th century when Pierre Fauchard first used the 'bandolet' to fix silver or gold bands to the teeth with a silk thread.

However, it was very quickly realized that if there were specific teeth to move, one would sometimes cause unwanted movement of other adjacent teeth. This is Newton's third law in practice: every action has an equal and opposite reaction.

To move only certain teeth in a certain way requires anchorage to a body that is less prone to movement. This may be multiple other teeth, or the opposing arch, or the skull via headgear. These forms of anchorage, however, are often dependent on patient cooperation to wear or activate the appliance for certain periods of time in the day. With the advent of endosseous implants, the idea of 'absolute anchorage' was developed because a seemingly infinite amount of orthodontic force can be applied to the implant without it's movement.

Taken from lalanorthodontics.com

Please enjoy this issue of **ProbeTips** which will review the use of various Anchorage Devices for orthodontic tooth movement and their efficacy.

Pamela A Nicoara DDS MSD PLLC

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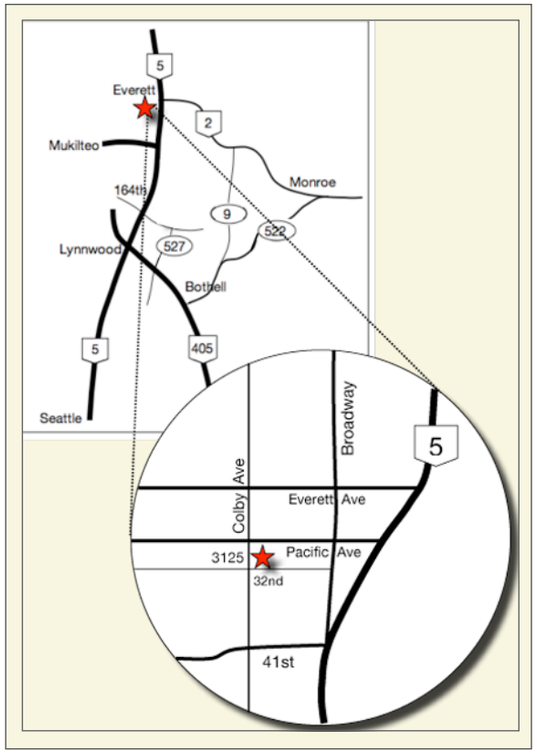

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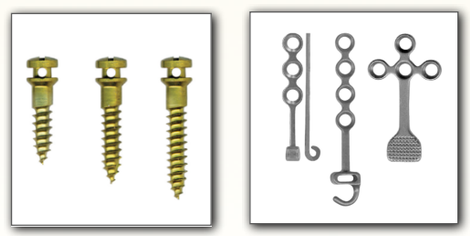
Probe Tips

A Quarterly Periodontal Newsletter

By Pamela Nicoara DDS MSD

Orthodontic Anchorage Devices



Volume 6, No. 1

May 2013

Anchorage Devices

General Considerations

Traditional orthodontics can accomplish the goals of facial balance, esthetics and optimizing occlusion for most clinical situations requiring mild to moderate changes. Those that benefit from the use of anchorage devices are those with more significant discrepancies skeletally or occlusally (anterior open bite or class III malocclusion), who refuse orthognathic surgery or are past an age of utilizing growth modification. Over time, bone anchorage systems may develop to replace orthognathic surgery. Limitations, however, include the need for good cortical bone for screw fixation. Patients should not be taking bisphosphonates, have had radiation, or be a smoker.

Endosseous Implants

Although endosseous implants can be used as absolute anchorage, their use is limited by their high cost, the delay in use due to the need for osseointegration, the difficulty in removal for the same reason, and their primary use for tooth replacement rather than orthodontic anchorage. In addition, certain tooth movements such as intrusion, are not easily accomplished with endosseous implants. However, their use is indicated in situations where significant tooth movement is necessary, and there are multiple missing teeth. Success rates of endosseous implants for orthodontic tooth movement were 100% in a 2012 review.

Astra Dental Implants

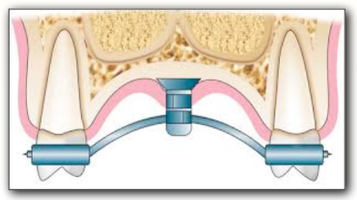
The case on the next panel demonstrates the use of surgical guides to place endosseous implants relative to *future* tooth position, and the outcomes that can be achieved. It is important to note the significant laboratory time involved to accurately transfer intended tooth and implant position from the orthodontic wax set-up to the surgical model for fabrication of the surgical guide.

Pre-Treatment Post-Treatment

Surgical guides for implant placement

Palatal Implants

Palatal implants also fall into a category of anchorage requiring osseointegration. They require a shift in traditional orthodontic mechanics because of the point of anchorage in the palate rather than on a tooth surface. Their use is limited primarily to maxillary tooth movement, with increased cost over mini-screws and -plates, 12 weeks of healing time necessary prior to engagement, and debate about growth disturbance of the median palatal suture. If the implants are placed parasagitally, one risks fistula formation when the implant is removed because of the thin bone in the region of the nasal floor. Success rates are in the range of 90% and palatal implants are found to be at least as effective as cervical headgear. However, due to the above mentioned difficulties, palatal implants are rarely used today.



Taken from Google Images

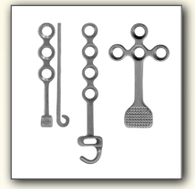
Mini-Screws

Mini-screws have gained significant popularity recently as an inexpensive, non-invasive means of achieving anchorage for more limited tooth movement. Mini-screws are typically placed interproximal of tooth roots to exit at the mucogingival junction. The most commonly reported uses were for anterior tooth retraction, molar distalization, and intrusion. Mini-screws can be moved through bone via tipping or body translation, so there is a potential to hit vital structures along its path of displacement. It is also important to consider whether the mini-screw will be in the way of moving teeth. Their use has also been riddled with difficulty by loss of integration in the bone over the course of orthodontic treatment, with success rates as low as 61%. Some dental sites offer better stability such as the palate or mandible because of the ability to use a longer screw for bicortical stabilization, or because of the denser bone found in the mandible. There is also difficulty occasionally in finding bone interproximal of tooth roots, particularly if root proximity is a problem.

KLS Martin Mini-screws

Mini-Plates

Mini-Plates offer the greatest reliability in non-tooth sites for absolute anchorage, and most types of tooth movement can be achieved with mini-plates. Because multiple short screws are used to fix the plate, screw loosening is minimized with success rates ranging from 91-100%, and are useful for cases requiring longer treatment times or greater forces. There is also the advantage to use sites such as the zygoma which have significantly more dense cortical bone over other maxillary sites. In addition, screws can be placed apical to tooth roots, rather than between them, affording greater options for placement in most instances over mini-screws.



KLS Martin Mini-plates

Taken from OMSCNA 2010

Conslusion

Although there is still much to be elucidated through research to determine the most effective and least invasive means of using anchorage devices, it is clear that the use of temporary anchorage devices in clinical orthodontics is "becoming the norm rather than the exception" (***J Clin Orthod*** Bushang et al 2008).

All cases are patients of Dr. Pamela Nicoara unless otherwise specified.