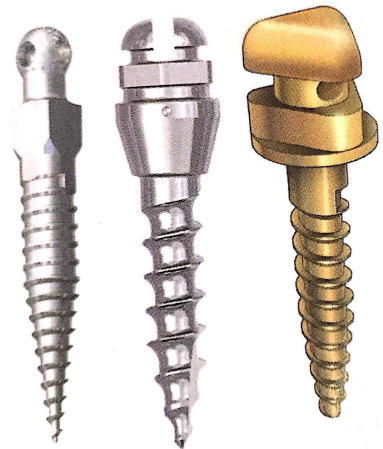


# Temporary Anchorage Devices (TADs)



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# Terminology

- In the literature, there is no general agreement about the terminology used

- ❖ Miniscrews

- ❖ Microscrews

- ❖ Miniscrew implants

- ❖ Mini-implants

# Survey of Orthodontists' Attitudes and Experiences Regarding Miniscrew Implants

J Clin Orthod. 2010; 44: 481-486

47 of 59 eligible orthodontists  
completed the survey, for an  
80% response rate

57% had been in practice more  
than 10 years

91% reported treating at least  
one patient with miniscrews

43% reported placing the  
devices personally

The most common reason cited for  
not placing miniscrews personally

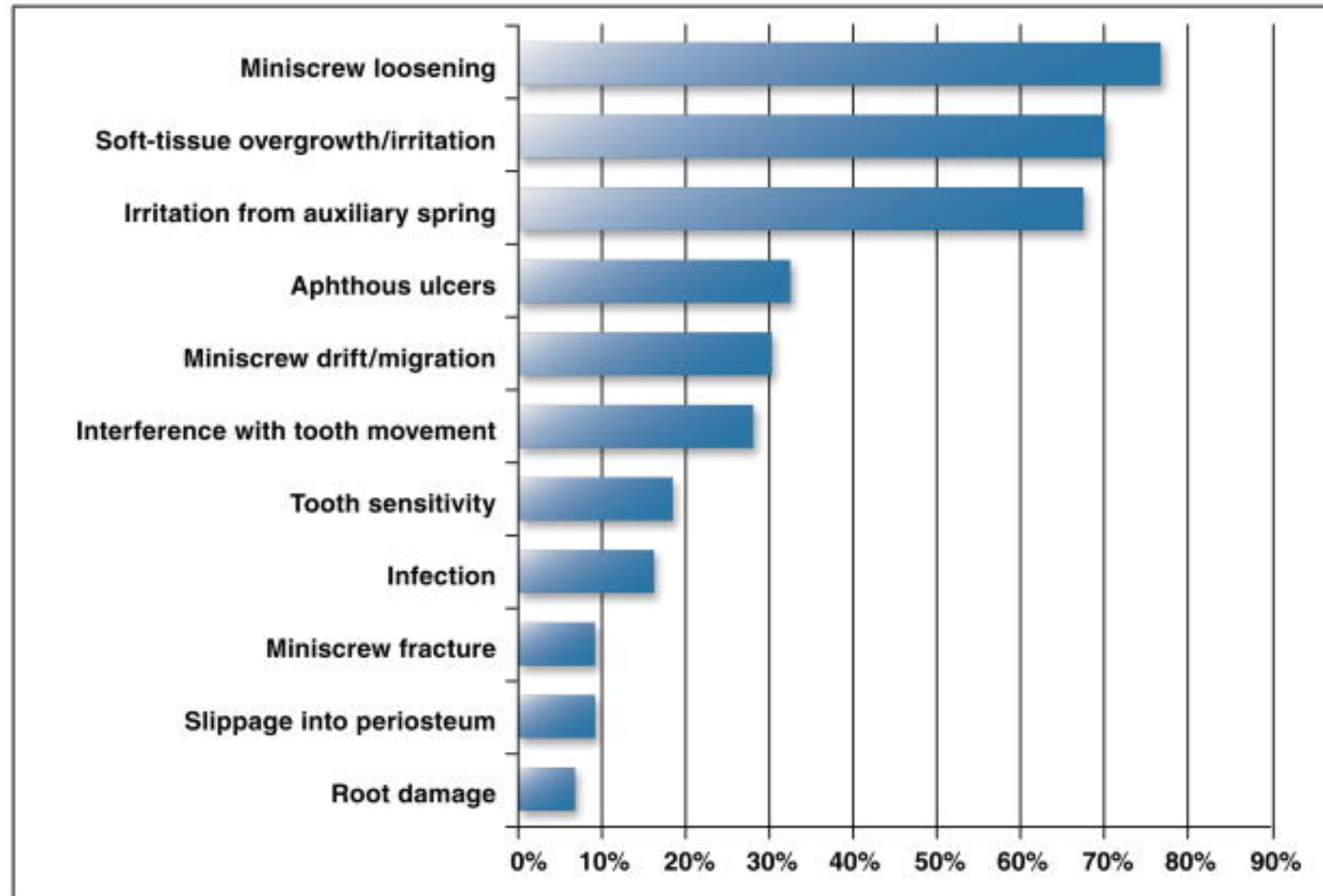
- The need to administer a local anesthetic (58%)
- Longer chair time (25%)
- Manage acute pain (20%)

## INDICATIONS FOR TREATMENT WITH MINISCREWS

|                                      | <b>Treated</b> | <b>Considered</b> |
|--------------------------------------|----------------|-------------------|
| Molar protraction                    | 64%            | 32%               |
| Indirect anchorage for space closure | 55%            | 36%               |
| Intrusion of supererupted tooth      | 52%            | 36%               |
| Intrusion for anterior open bite     | 41%            | 45%               |
| Anterior en masse retraction         | 39%            | 52%               |
| Molar uprighting                     | 36%            | 52%               |
| Intrusion for maxillary cant         | 34%            | 43%               |
| Molar distalization                  | 27%            | 45%               |
| Traction on impacted canine          | 16%            | 43%               |
| Attachment of protraction facemask   | 0%             | 27%               |



# Percentages of orthodontists reporting various biological or mechanical complications of miniscrew implants



# Acceptance of Orthodontic Miniscrews as Temporary Anchorage Devices

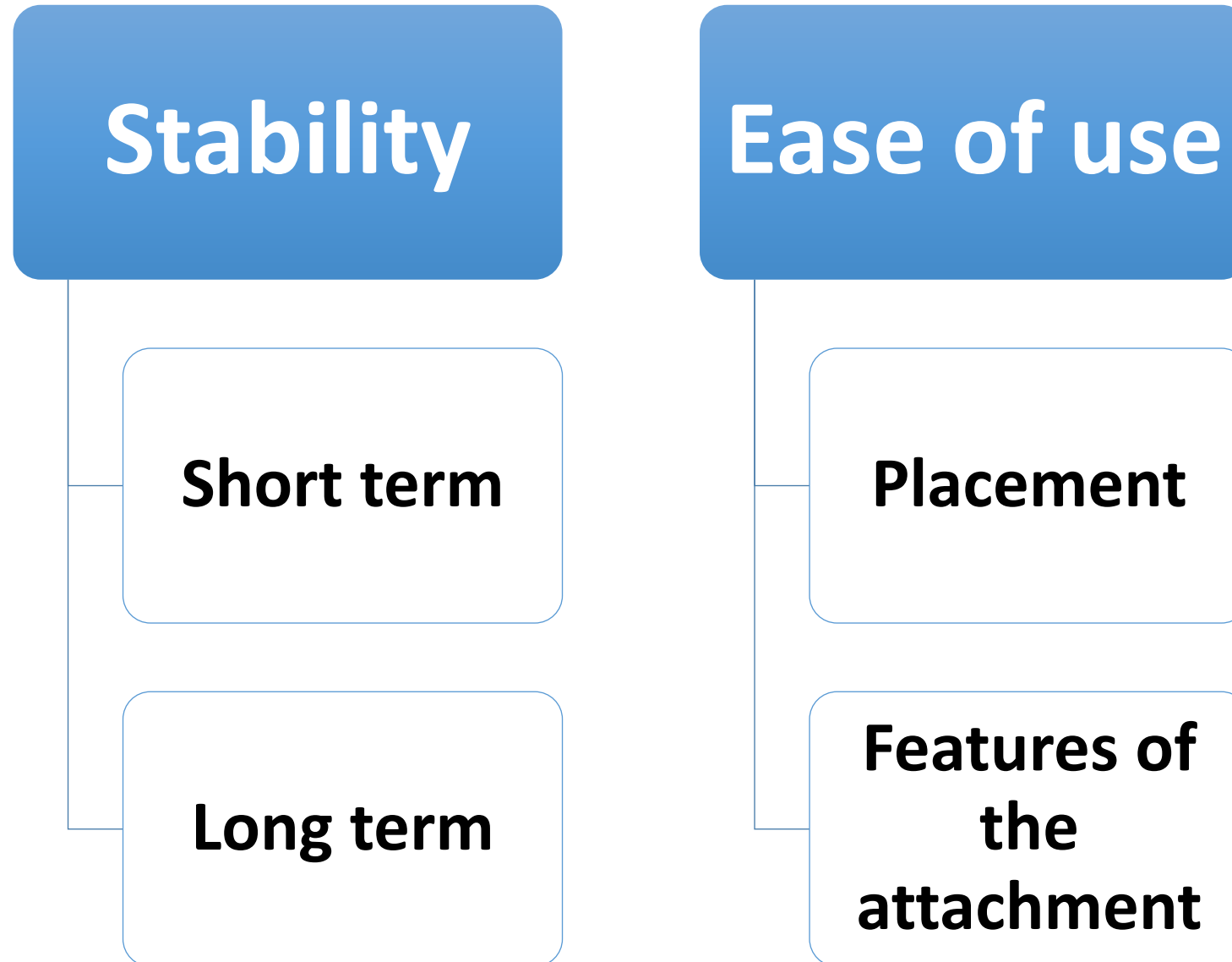
Khalid Zawawi. Patient Preference and Adherence. 2014;8 933–937

- **It was concluded that patients do accept miniscrews as a treatment option in orthodontics**
- **Postoperative pain was significantly low**
- **32.5% of the participants did not require any pain medication post-miniscrew placement and 59.1% required only a single dose of an analgesic**
- **There were no differences between the sexes in the overall pain experienced after 24 hours of miniscrew placement**
- **Patients preferred miniscrews to extractions**

# Placement Sites

- **Inter-radicular space between tooth roots, either buccally or lingually**
- **Hard palate (midpalatal/parapalatal region)**
- **Below the anterior nasal spine**
- **Infrazygomatic crest**
- **Maxillary tuberosity**
- **Edentulous areas**
- **Chin and retromolar areas**

# Important Considerations



# Success rates for miniscrews

- It was reported that placement of the miniscrews in the maxilla or mandible was not associated with the success rate. (Miyawaki et al. Factors associated with the stability of titanium screws placed in the posterior region for orthodontic anchorage. American J Orthod. Dentofacial Orthop. 2003;124(4): 373-378)
- The maxilla had a higher success rate than the mandible (Park et al. Factors affecting the clinical success of screw implants used as orthodontic anchorage. American J Orthod. Dentofacial Orthop. 2006;130(1): 18-25)
- The area between the first and second premolars in the maxilla and mandible of both young and adult patients had the highest success rate (Moon et al. Factors associated with the success rate of orthodontic miniscrews placed in the upper and lower posterior buccal region. Angle Orthod. 2008;78(1): 101-1060)

# Critical factors for the success of orthodontic mini-implants: A systematic review

Am J Orthod Dentofacial Orthop 2009;135:284-91

- **Healing time seems unnecessary for mini-implants, because the 6 studies with immediate loading had high success rates.**
- **Most mini- implants can withstand 100 to 200 g of horizontal force early or immediate loading successfully**
- **A force system generating a moment to the implant in the unscrewing direction caused an implant to fail**

# Factors to improve primary stability

- **Quality and quantity of the bone**
- **Thickness, type and health of the soft tissue**
- **Cortical bone with a thickness of less than 0.5 mm is not suitable for miniscrew placement**
- **Higher success rates have been reported with cortical bone at least 1.0 mm thick**
- **To maximize stability, it is better to place miniscrews in the attached gingiva (keratinized gingiva), which is more resistant to inflammation and less likely to develop soft-tissue hypertrophy**

# Different Types of Screw TADs

There are Differences in:

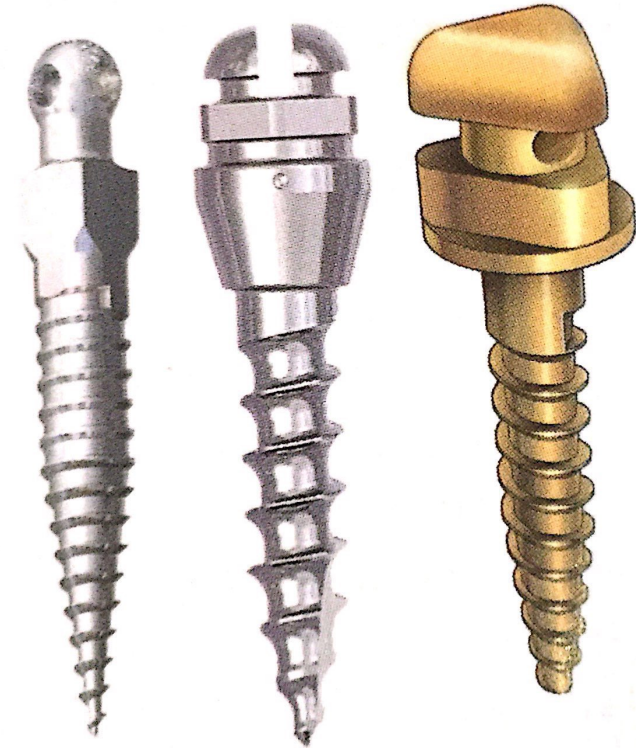
The shape of the head

The shape of the collar

The shape (form) of the screw

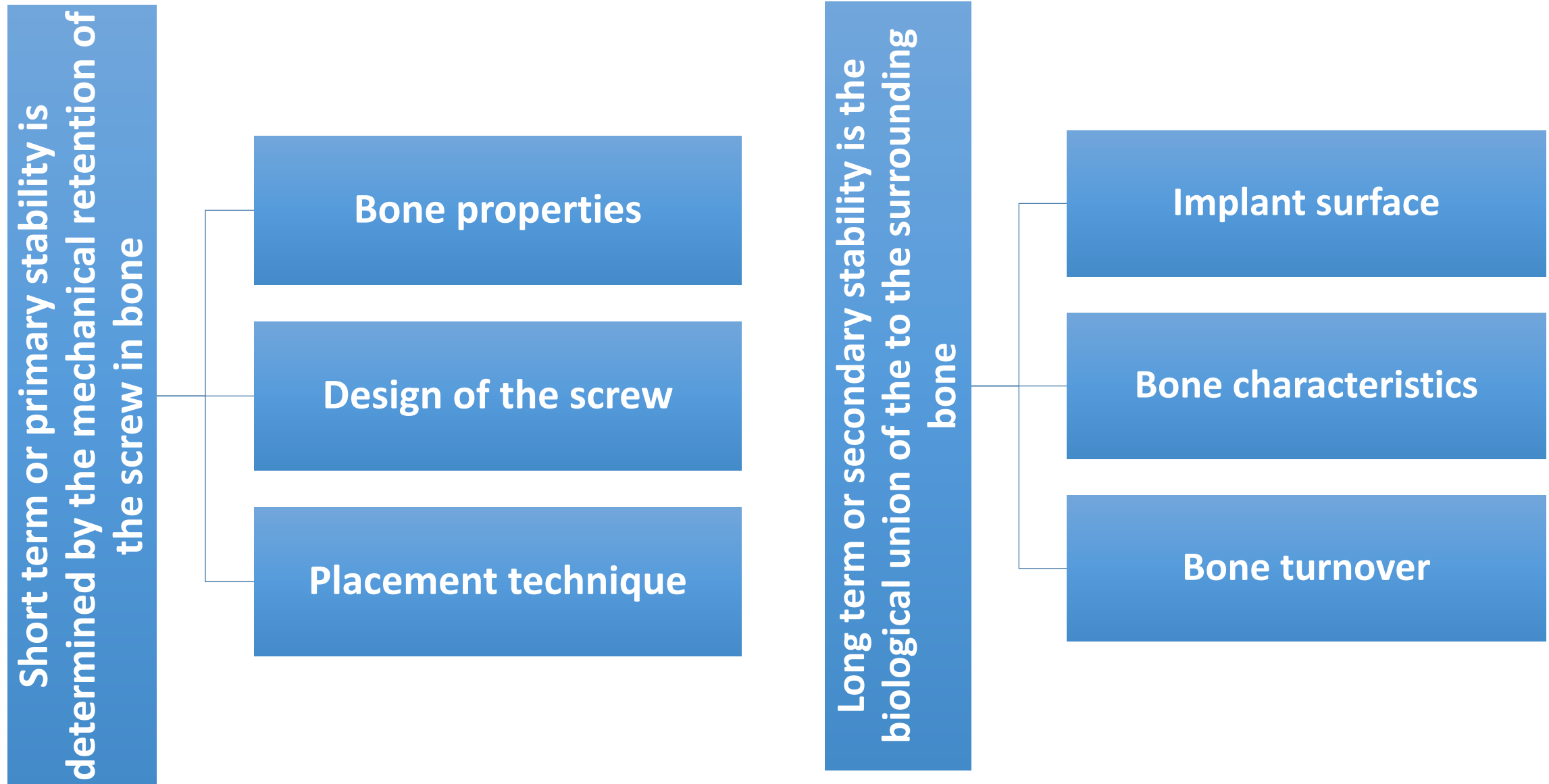
The screw threads

The pitch (separation) of the screw threads



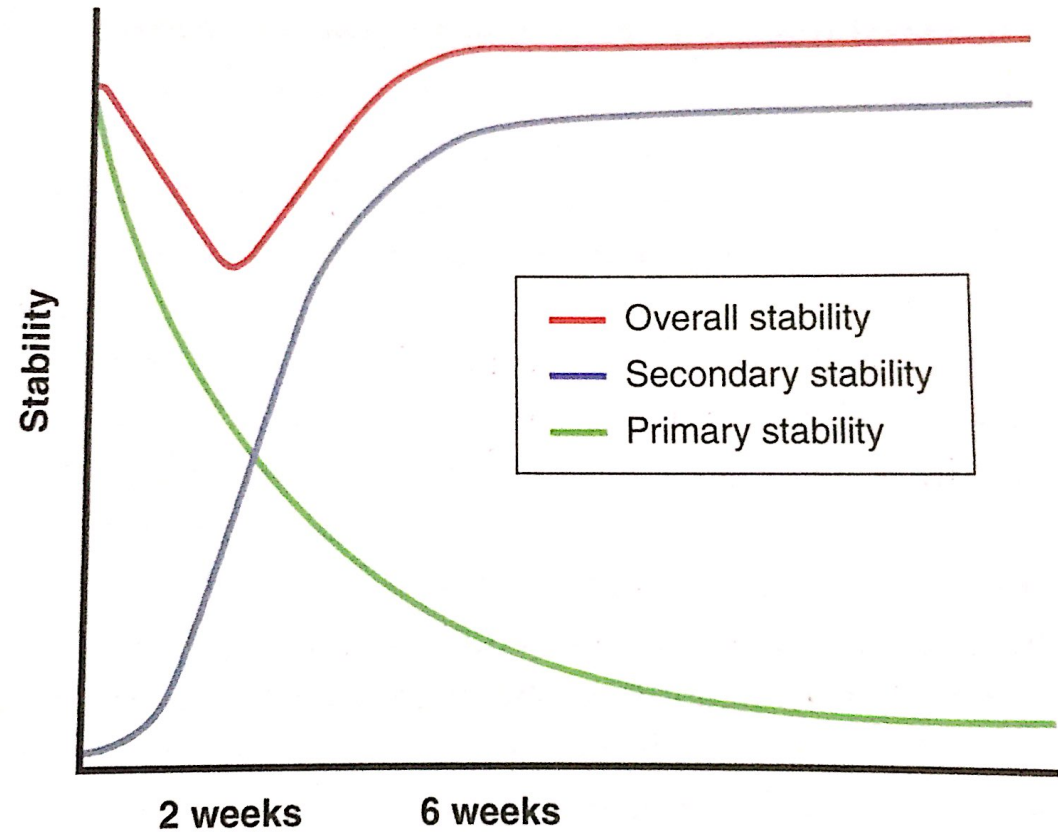


# Stability of Bone Miniscrews



# Stability of Bone Miniscrews

**Clinical stability is the sum of primary and secondary stability and is the major factor to clinical success**



W. Proffit. Contemporary Orthodontics. 5<sup>th</sup> edition

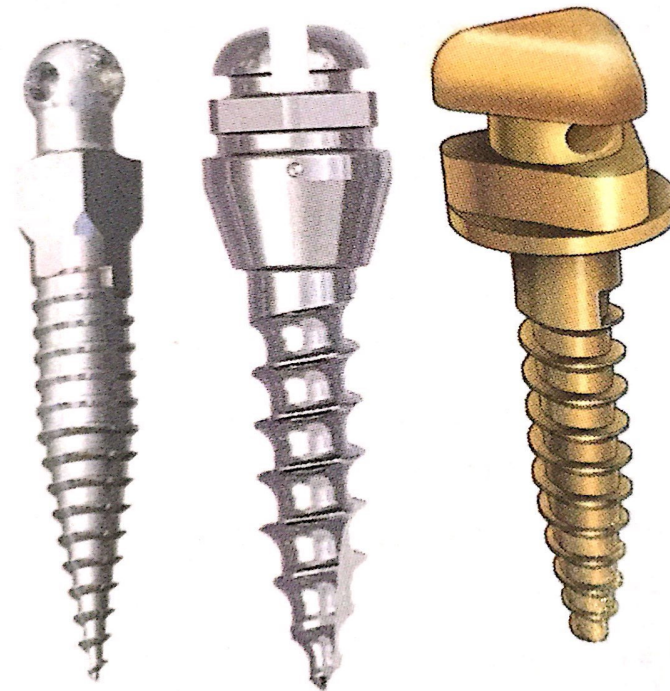
# Design factors related to the Stability of the Miniscrew

- **Pitch of the screw threads: tight vs. loose**
- **Length of the screw (6 -10 mm)**
- **Diameter of the screw (1.3-2 mm)**
- **Shape of the screw: conical, cylindrical, or mixed**
- **Form of the tip: thread forming screw vs. thread cutting screw**
- **Surface of threaded part of the screw: machined or roughened**

## Pitch of the screw threads: tight vs. loose

**A tighter pitch of the threads near the head of the screw gives greater contact with the cortical bone that leads to higher pull out strength and better primary stability**

**(Brinly et al. Pitch and longitudinal fluting effect on the primary stability of miniscrew implants. Angle Orthod. 2009; 79:1156-1161)**



# Length of the screw (6 -10 mm)

- A shorter miniscrews perform as well as the long ones
- The most commonly used miniscrews are the 6 and 8 mm
- The contact with cortical bone is the major factor in stability

# The Diameter of the Screw

## Important factors:

Clearance between the screw and the adjacent roots

Resistance to fracture or displacement

TADs diameter currently available on the market range is 1.3-2 mm

In this range of diameter, stability and success depends on the amount of cortical bone contact

# Taper of the Screw

Conical screws are thicker than cylindrical screws near the head

Conical screws show greater microdamage to cortical bone than cylindrical screws

Microdamage of cortical bone may affect secondary stability.

# The Form of the Tip (Self-Tapping)

## Thread-Forming

**It compresses the bone around the thread**

**Obtain better bone screw contact**

**It is for use with alveolar bone**

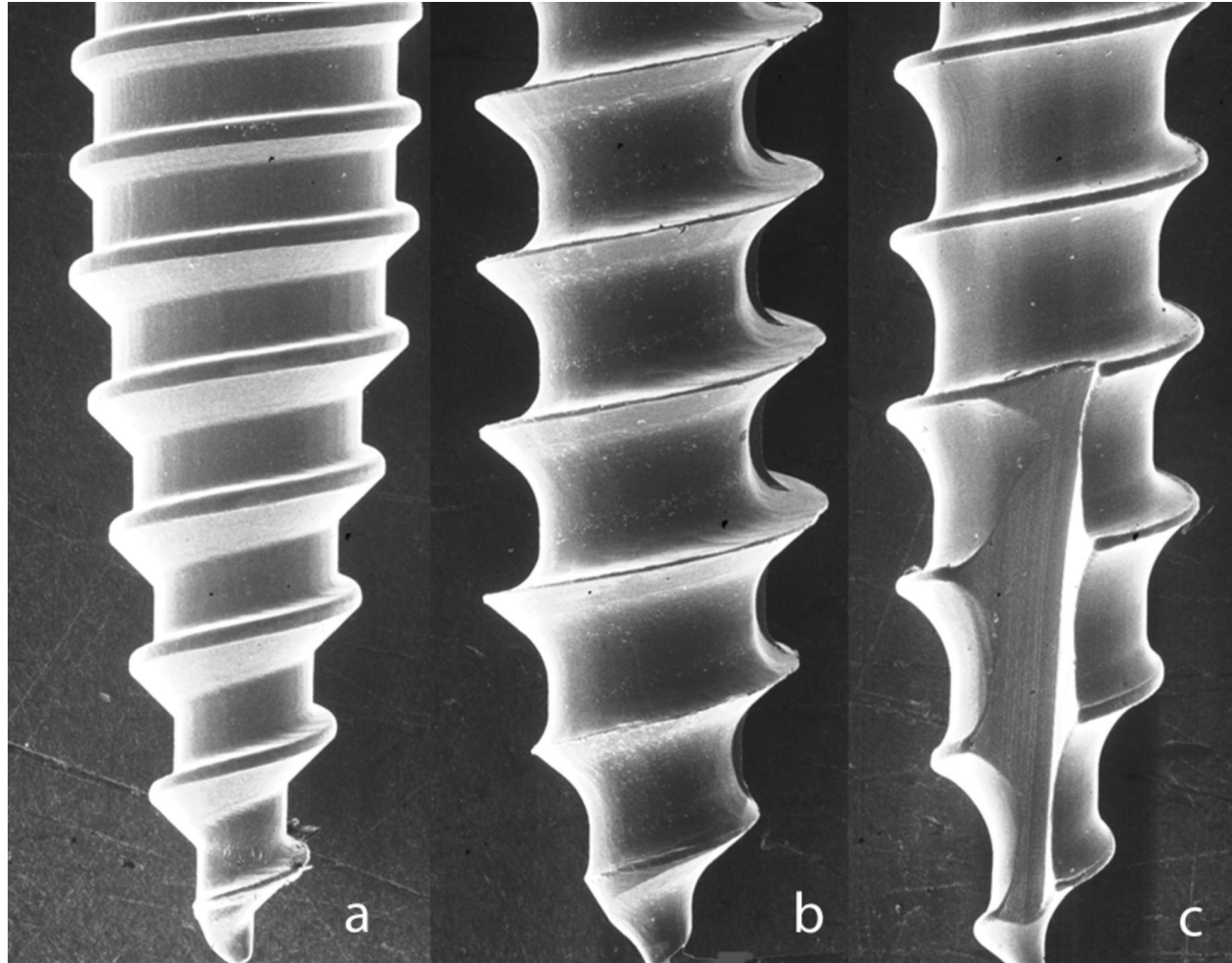
## Thread-Cutting

**It has better penetration into denser bone**

**It performs better in the mandibular buccal shelf, zygomatic buttress, and palate**



# The Form of the Tip (Self-Tapping)



# Surface Treatment of the Screw

- **Some animal studies suggest that sand-blasting or acid-etching increases primary stability and allow immediate loading** (kim et.al. removal torque values of surface treated mini-implants after loading. Am J Orthod. Dentofacial. Orthop. 2008; 134:36-43)
- **The screw's surface characteristics do not seem to be a major influence on clinical stability** (Chaddad et. al. influence of surface characteristics on survival rates of mini-implants. Angle Orthod. 2008; 78: 107-113)

# Factors Affecting the Ease of Placement

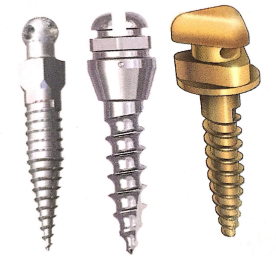
Self-drilling screws eliminated the need for a pilot hole

If the cortical bone is thick, then a pilot hole is needed. this may prevent screw fracture

A tissue punch is rarely needed unless a pilot hole is to be drilled

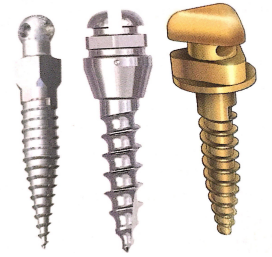
High insertion torque increases primary stability. However, it may increase the chance of fracture of the screw

# Direction of Placement



- Kyung et al. proposed inserting miniscrews at 30-40° angulations to the long axis of the teeth in the maxilla, and 10-20° in the mandible (Development of Orthodontic micro-implant for intra-oral anchorage. J Clin Orthod. 2003; 37:321-328)
- Oblique angle of insertion in an apical direction in the maxilla and parallel to the roots in the mandible (Melson. Mini-implants. Where are we? J clin Orthod. 2005; 39: 539-547)

# Complications



- ***Clinician-related complications:*** Clinicians' skills and experience are critical to the success rate of the procedure
- ***Patient-related complications:*** These result from factors such as systemic diseases, periodontal disease, osteoporosis, drugs, pharmacologic prescriptions such as bisphosphonates, poor oral hygiene, smoking and cortical thickness of the bone

# *Miniscrew-related complications:*

Pain and discomfort, irritation to tongue or cheek

Inflammation around miniscrews

Soft-tissue impingement

Damage to surrounding anatomical structures

Miniscrew mobility or failure

Root injury

Fracture of miniscrews

# Pain and discomfort, irritation to tongue or cheek

- Generally, patients do not experience pain and discomfort following miniscrew placement
- If pain is present, it may last 1–2 days
- Cheek irritation was generally not observed when miniscrews were placed in the buccal alveolar bone
- When placed in the palatal area, tongue irritation primarily occurred
- Bonding resin or a periodontal wound dressing can be applied to the head of the miniscrew to smooth its surface and to minimize soft-tissue irritation







# Inflammation around miniscrews

- Inflammation is the most commonly observed complication, and is considered to be the major factor in miniscrew failure
- If the miniscrew is placed in the attached gingiva or in the palatal mucosa, less inflammation was observed
- When miniscrews were placed in the oral mucosa, deep in the vestibule or near a frenum, inflammation occurred
- Mild infections can be controlled by using antiseptic mouthwash and by brushing
- Inflammation or swelling around a miniscrew might be the result of it loosening, rather than the cause



# Soft-tissue Impingement



- When the miniscrew is placed deep in the vestibule, into the free gingiva or the retromolar area, the head of the miniscrews may become embedded in the overgrowth of surrounding soft tissue
- Placing miniscrews into attached gingiva can avoid soft-tissue impingement over the head of the screw

# Damage to surrounding anatomical structures

- When placing the miniscrew in the palatal alveolar bone, angular placement near the apex of the roots of the maxillary molars will reduce the risk of making contact with the greater palatine nerve and artery, which are situated higher in the palate



# Root Injury



- Clinicians need to evaluate the distance between the roots using periapical or panoramic radiographs to avoid root contact during placement
- A safety clearance of 2 mm is recommended in interdental areas
- A small amount of local anesthesia is preferred, so that the patients can feel it if the miniscrew touches the root.
- Researchers have determined that close proximity or contact between a miniscrew and a root can be a major risk factor for failure of the procedure

# Root Injury



- If trauma to the root does not involve the pulp and is limited to the cementum or the dentin of the tooth, the prognosis is good and healing will take place (Brisceno et al. Healing of the roots and surrounding structures after intentional damage with miniscrew implants. American J of Orthod Dentofacial Orthop. 2009;135: 292-301)
- After removal of the miniscrew, the damaged root will be repaired in 12–18 weeks
- During orthodontic treatment, contact between the root and the miniscrew may occur as the tooth moves. The tooth will then stop moving and the miniscrew may become mobile

# Miniscrew Mobility or Failure



- **Miniscrew dislodgement and mobility mostly occur in the first 1–2 months and more than 90% of the failures occur within the first 4 months**
- **When a miniscrew has resisted more than a 4-month period of force application, it can be considered successful and stable** (Moon et al. Factors associated with the success rate of orthodontic miniscrews placed in the upper and lower posterior buccal region. Angle Orthod 2008;78: 101-106)
- **When mobility occurs, the clinician can tighten the miniscrew and leave it for 1–2 months with no loading, or light loading if necessary** (Lindauer SJ, Shroff B. Temporary anchorage devices: Biomechanical opportunities and challenges. In: R. Nanda and S. Kapila (ed.) Current therapy in orthodontics Mosby Inc. 2010; p278-290)



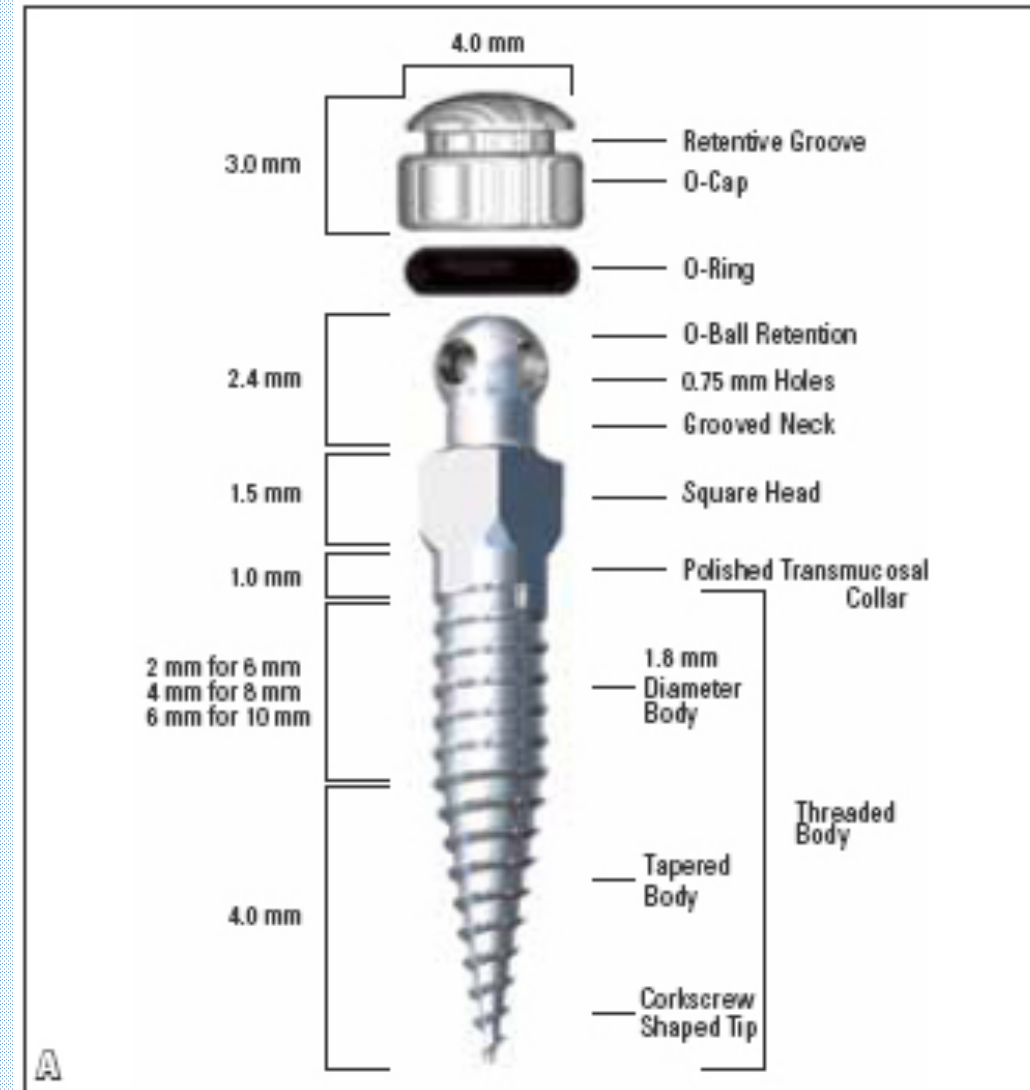
# Miniscrew Mobility or Failure



- The success rate was higher for the below 20 years age group compared with the over 20 years age group, which might be explained by the higher rate of metabolism in the young adult (Park. Korean J of Orthod 2003;33: 151-156)
- There was no significant difference in the success rates of the below 20 years age group, the 20–30 years age group and the over 30 years age group (Miyawaki et al., American J Orthod Dentofacial Orthop 2003;124: 373-378)
- Success rate tends to be lower in younger patients (< 20 years old) compared with older patients (> 20 years old) (Kim JS et al. Korean J Orthod 2012;42: 242-248).

Unitek Temporary Anchorage Device (TAD)  
System  
Ti-6Al-4V alloy screw

- Immediate loading
- Self tapping and self drilling
- No incision or flap necessary
- Drill-free, requiring no pilot hole
- 1.8 mm miniscrew implant made from Titanium alloy
- Stainless steel Cap
- Retentive groove and 0.076 mm (0.030 in) holes for attachment



## Unitek™ Temporary Anchorage Device Locations

| Length | Implant Location  |
|--------|---|
| 6 mm   | Facial surface maxillary/mandibular alveolar ridge mesial to 1st molar, maxillary subANS region, mandibular symphysis   |
| 8 mm   | Facial surface maxillary/mandibular alveolar ridge distal to 2nd premolar, parasagittal midpalate   |
| 10 mm  | Maxillary tuberosity, zygomatic buttress, infrazygomatic crest or posterior lateral palate; mandibular ascending ramus, retromolar region, external oblique ridge |



**Tomas (Dentaurum)**  
**Titanium Alloy Grade V (Ti-6Al-4V) Device**  
**1.6 mm Diameter**

***Ortho-Design***

**Pin head in bracket design for proven orthodontic techniques**

***New undercut***

**Uniquely simple, ligature-free fixation of the orthodontic appliance using LC adhesive**

***Slot marking***

**With 4 slot markings for optimal detection of the slot position**

***Depth stop***

**Maximum safety by maintaining the planned insertion depth**

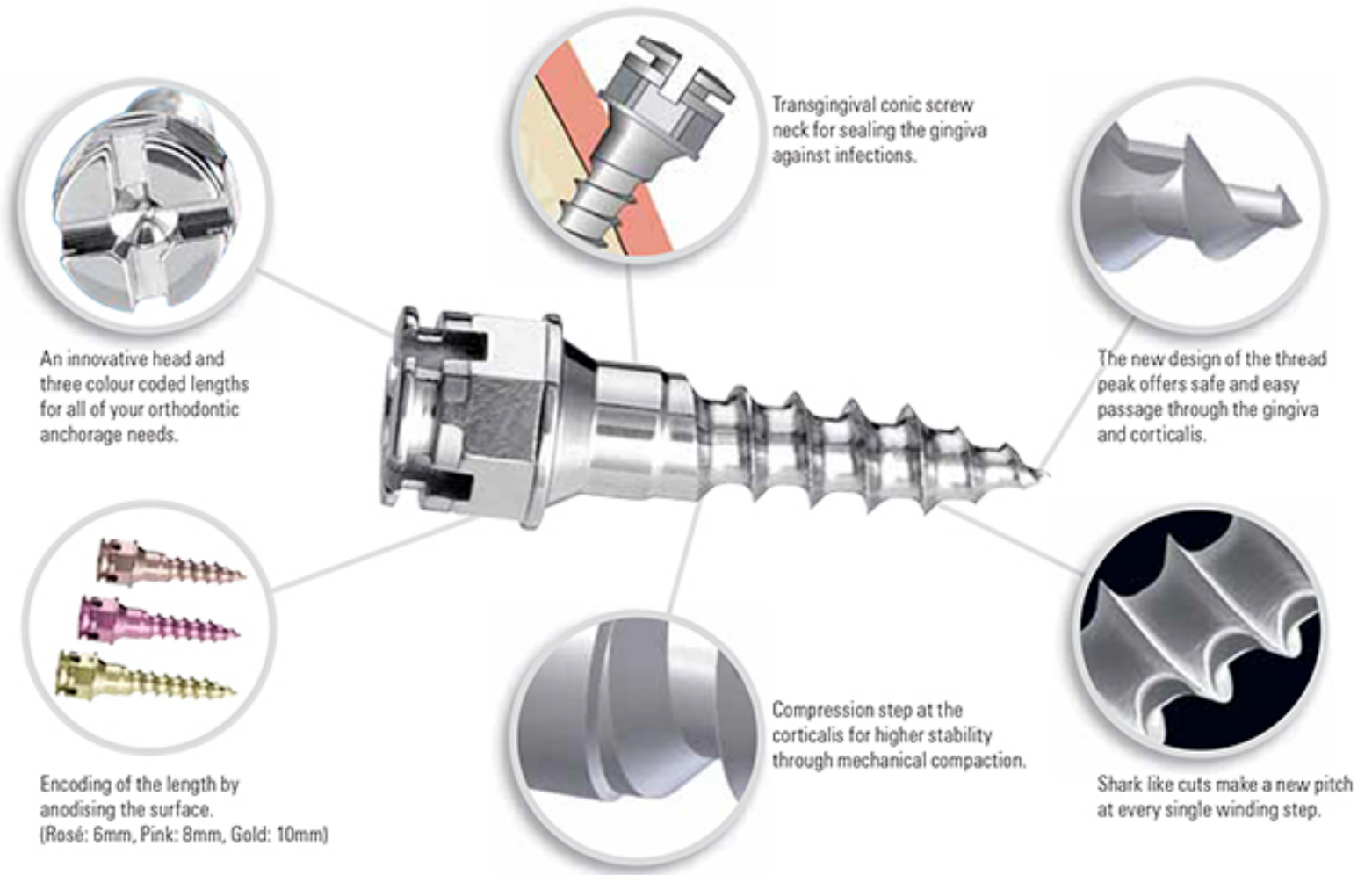
***GingiFit ©***

**Polished, conical collar for perfect gingival adaptation without the risk of compression  
– ideal for preventing inflammation**



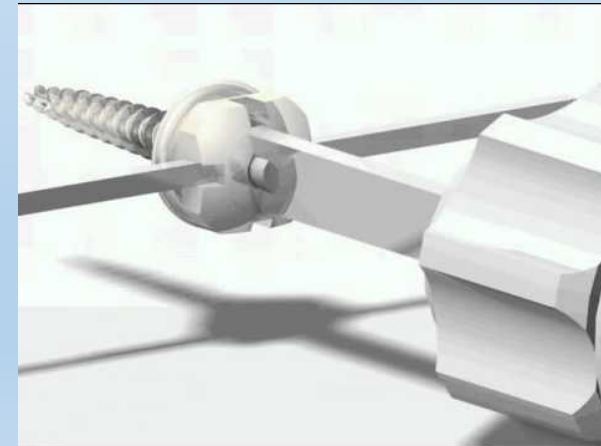
# Ortho Easy (Forestadent, Pforzheim, Germany)

- It is a titanium alloy grade V
- 1.7 mm diameter
- *Self-cutting and self-drilling pins*
- The head of the screw is bracket-like
- *Reduced vertical height of the head*
- *Shark like cuts for easy insertion with low torque, reduced bone pressure, better primary stability*
- *Transgingival conic screw neck (2 mm)*



# Spider Screw (Ortho Technology)

- Spider Screw K1 1.5 mm and Spider Screw K2 1.9 mm
- Immediate loading of forces up to 300 grams
- Long neck for areas of thick or freely moving tissue, usually posterior regions
- Short neck for areas of thin attached gingiva, usually anterior regions
- Bracket like head with two intersecting .022" slots
- Under tie wing area which can function as another slot



# Post-Placement Instructions

- **Take 800 mg ibuprofen immediately, then 400 mg as needed for dental discomfort**
- **Rinse with 15 ml of 0.12% Chlorhexidine Gluconate for 30 seconds twice a day for 10 days**
- **After 10 days, rinse with 15 ml of 0.12% Chlorhexidine Gluconate for 30 seconds as needed for peri-implant erythema**
- **Avoid tongue or finger contact with the miniscrew**
- **Do not eat anything hard, chewy, or sticky in the vicinity of the miniscrew**