Brochure for the Absoanchor® Orthodontic Microimplant

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AbsoAnchor

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Development of the Orthodontic Microimplant (Absoanchor®)

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1. Introduction

Clinicians continue to need anchorage that displays a high resistance to displacement. According to Newton's Third Law, there is a reaction for every action, control of which is difficult to achieve intraorally. Earlier, orthodontists used extraoral traction to reinforce intraoral anchorage. Nevertheless, patients seldom used headgears 24 hours a day - 7 days a week, hence this source of anchorage was often compromised.

The ideal intraoral anchorage would not displace, and would require a source devoid of periodontal membrane, which tends to respond to tension and pressure allowing movement through bone. Recently, prosthetic osseointegrated implants have been used as intraoral orthodontic anchorage, but their bulky size, cost and invasiveness have limited their orthodontic application.

We have used ordinary bone screws first to provide intraoral anchorage, but the screw heads failed to protect the gingiva from the impingement by the ligatures or attached elastomers. These became a source of constant gingival irritation and inflammation, which limited the usefulness of this type of implants. The design of the screw heads also made it difficult to connect coil springs and other elastomers to these ordinary bone screws. The development of small diameter titanium microimplants with specially designed heads that accept ligatures, coil springs and elastomers have helped to solve the main objections to previous implants and screws (Fig. 1).

The titanium alloy microimplant (Ti6Al4Va), Absoanchor® (Dentos Inc., Daegu City, Korea), has been designed specifically for orthodontic use and has a button-like head and a bracket-like head with a small hole that accepts ligatures and elastomers (Fig. 2). The Absoanchor's smaller diameter of 1.2mm-2.0mm allows its insertion into many areas of the maxilla and mandible previously unavailable, e.g., between the roots of adjacent teeth.

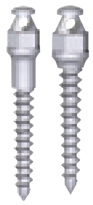
Fig. 1. A typical surgical microscrew (left) and the newly designed Absoanchor® microimplant with nickel titanium coil springs attached (right).

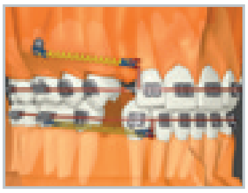
Fig. 2. Orthodontic Absoanchor® microimplants developed by Dentos Inc.

2. Types of Absoanchor® Microimplant

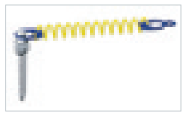
Several types of Absoanchor® microimplants are available for different tasks and sites.

Small Head (SH) Type



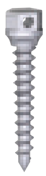


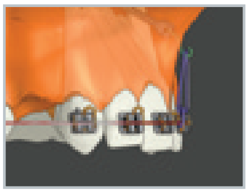
Recommended Site
Maxillary and mandibular attached gingiva including palate.



Recommended Elastomer
Nickel titanium coil spring and elastomeric thread etc.

No Head (NH) Type

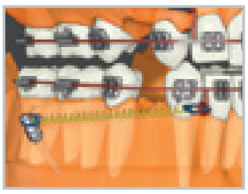




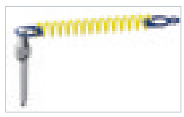
Recommended Site
Maxillary and mandibular movable soft tissue.

Recommended Elastomer
Elastomeric thread with ligature wire hook etc.

Long Head (LH) Type

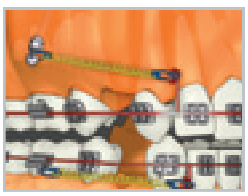


Recommended Site
Border area between mandibular attached gingiva and movable soft tissue.

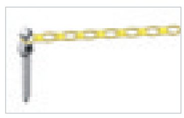


Recommended Elastomer
Nickel titanium coil spring and elastomeric thread etc.

Circle Head (CH) Type

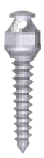


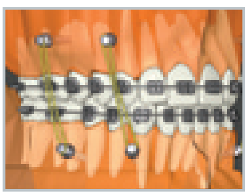
Recommended Site
Maxillary and mandibular attached gingiva including palate.



Recommended Elastomer
Power chains, elastomeric thread and nickel titanium coil spring etc.

Fixation Head (FH) type

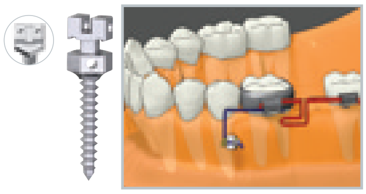




Recommended Site
Maxillary and mandibular buccal area for intermaxillary fixation. Also, palate including midpalatal suture area.

Recommended Elastomer
Ligature wire and/or rubber band for intermaxillary fixation. Also, power chains, elastomeric thread and nickel titanium coil spring etc.

Bracket Head(BH) Type-(Right & Left handed screw)



Recommended Site
Maxillary and mandibular attached gingiva including palate.

Recommended Elastomer
Power chains, elastomeric thread, nickel titanium coil spring etc. Archwire insertion is possible.

In the Bracket Head type, we developed two kinds of screws depending on the driving directions. The so-called Left Handed Screw is turned in a counterclockwise direction during insertion; the Right Handed Screw is turned clockwise during placement. (Fig. 3).

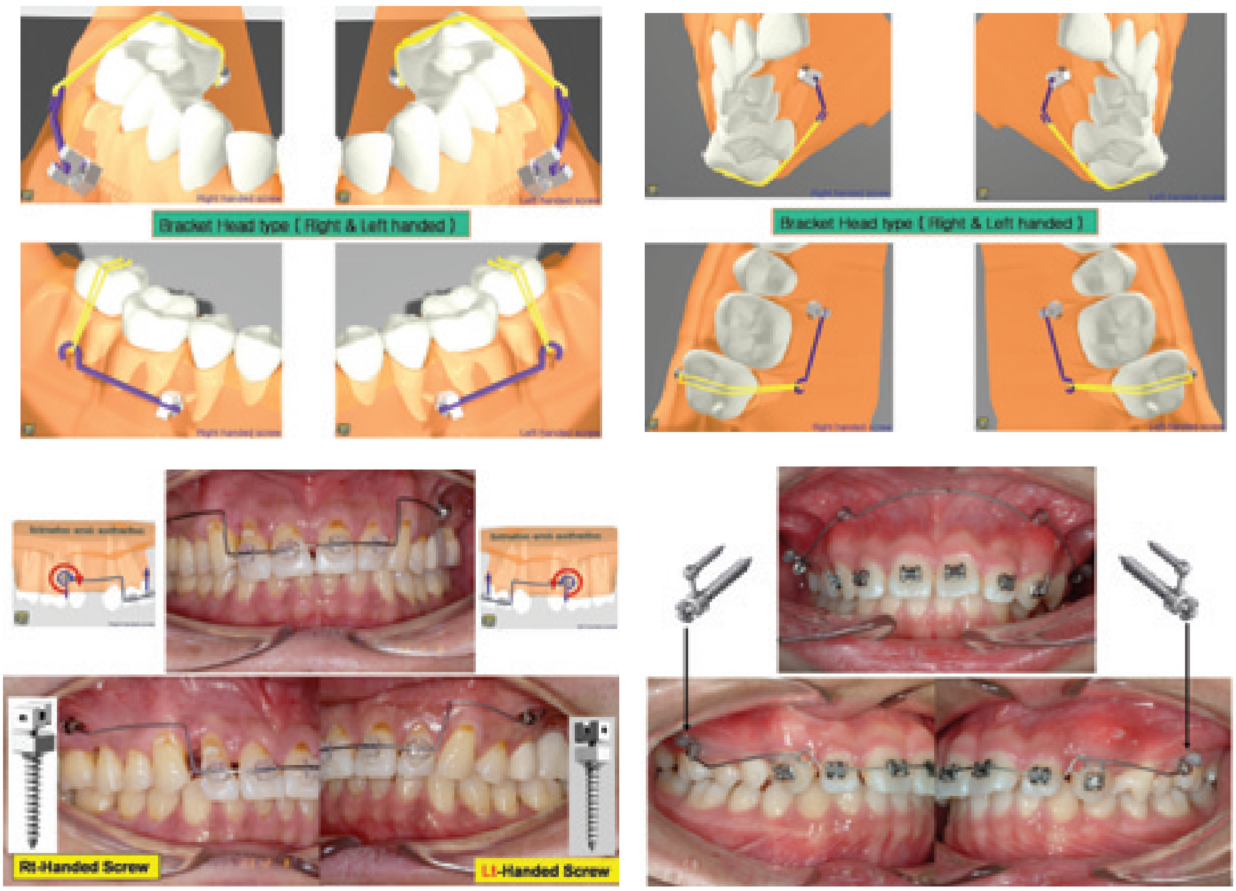


Fig. 3. Possible clinical application of Bracket Head (BH) type microimplants.

3. Guidelines in Selecting Microimplant Size

1) According to the Length of Microimplant

We recommend using microimplant lengths of more than 6 mm in the maxilla, and 5 mm in the mandible. The cortical surface of the maxilla is thinner and less compact than is that of the mandible and accordingly will require longer microimplants. A general rule of thumb is to use the longest possible microimplant without jeopardizing the health of the adjacent tissues. The proper length of the microimplant is best selected during the pilot drilling procedure.

Further, one has to consider the path of insertion of a microimplant when choosing the correct size. It obviously is better and relatively easier to place a microimplant in a direction perpendicular to the bony surface. There are many situations, however, when the microimplant has to be placed in a direction diagonal to adjacent roots in an effort to avoid injuring them. Thus, when the microimplant is inserted with a diagnonal path instead of a perpendicular path, it is prudent to use a slightly longer microimplant.

In order to obtain better mechanical retention, it is best to choose a longer and thicker microimplant, rather than shorter and smaller one. There are limitations, however, in choosing the same size of microimplant in different places. The soft tissue thickness as well as the quality of bone always should be considered at the sites where the implants are to be placed.

2) According to the Diameter of Microimplant

The Absoanchor® system uses numbers to describe the implant series. The No. 12 series (1.2mm in diameter) and No. 13 series (1.3mm in diameter) both can withstand up to 450g of orthodontic force when the patient has sufficient cortical bone. However, it should be remembered that the maximum required intraoral orthodontic forces seldom exceed 300g. When using forces greater than 300g, clinicians may select the No. 14 series (1.4mm in diameter), No. 15 series (1.5mm in diameter), or 16 series (1.6mm in diameter).

When there is no initial tightness following the placement of a No. 12 or No. 13 series microimplant, the clinician should select the next larger size until there is a close fit between the microimplant and the bone. Typically, the first Absoanchor® microimplant should be either a No. 12 or 13 of the Cylinder or Tapered design. Nos. 17 18 and 20 series are designed specially for intermaxillary fixation during orthognathic surgery.

In the mandible, the buccal surfaces and retromolar areas offer adequate thickness and high quality cortex for the acceptance of microimplants. Usually, microimplants of 4~5mm in length and 1.3~1.4mm diameter provide adequate retention. A microimplant with a 1.5~1.6mm diameter might improve retention when cortical bone is less dense or when greater force is needed; *e.g.*, when moving the entire mandibular dentition distally. Occasionally when mandibular lingual microimplants are needed, tori can serve as excellent implant placement sites.

When implants of a larger diameter are used, especially when they are made of low grade pure titamnium, there is more possibility of difficulty in removal after usage due to their osseointegration.

4. Terms used in Microimplant surgical procedures.

Microimplant Anchorage(MIA) in orthodontics is a relatively new field in orthodontic treatment. So here we are going to introduce some descriptive terms, that are used in this brochure.

The term "micro-" is used to emphasize the small size (such as in the terms like micrognathia, microsomia, microtia, microglossia and microdontia etc.). The term "implant" will be used instead of screw because when a foreign object is retained in the human body for more than one month, it can be classified in the implant category (see MDD 93/42/EEC dated 14 June 1993 concerning medical device, ANNEX IX, 1.2) which is the European equivalent to FDA approval.

1) According to head exposure (Fig. 4)

(1) Open Method

When the head of microimplant is exposed in the oral cavity. Usually, this method is possible when the microimplant is placed in a tight soft tissue area like the attached gingiva.

(2) Closed Method

When the head of the microimplant is embedded under the soft tissue. When the microimplant is placed in a movable soft tissue area with the open method, the soft tissue will grow around and embed the microimplant head during treatment. In this situation, it is better to avoid trying to have the microimplant head sufficiently out of soft tissues, because the microimplant head can easily be buried under the growing soft tissues.

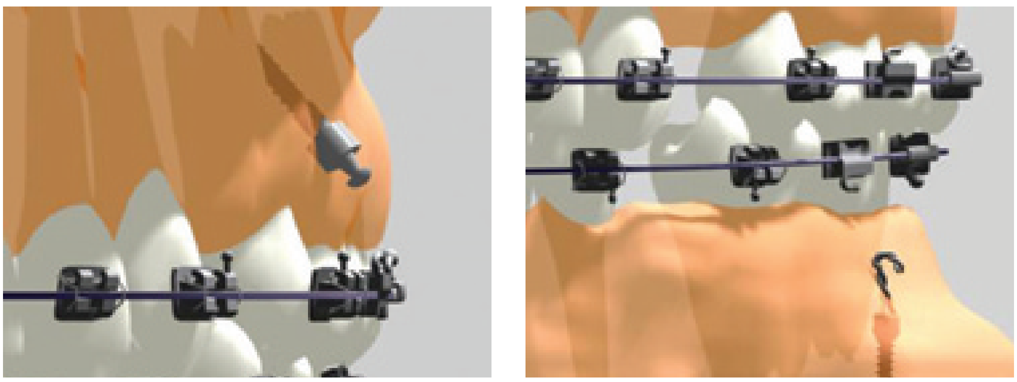


Fig. 4. Open (left) and closed (right) method of microimplant insertion.

2) According to the Driving methods

(1) Self-tapping method (Fig. 5)

A tunnel is drilled into the bone first by way of a bone drill, followed by the implant being driven into that tunnel. This method is used when small diameter microimplants or microimplants that are made of low grade pure titanium are inserted.

2) Self-Drilling (Drill-free) method (Fig. 6)

The implant itself drills into the bone as it is being driven in the bone. This method can be used when a larger diameter pure titanium microimplants or microimplants that are made of titanium alloy are inserted.

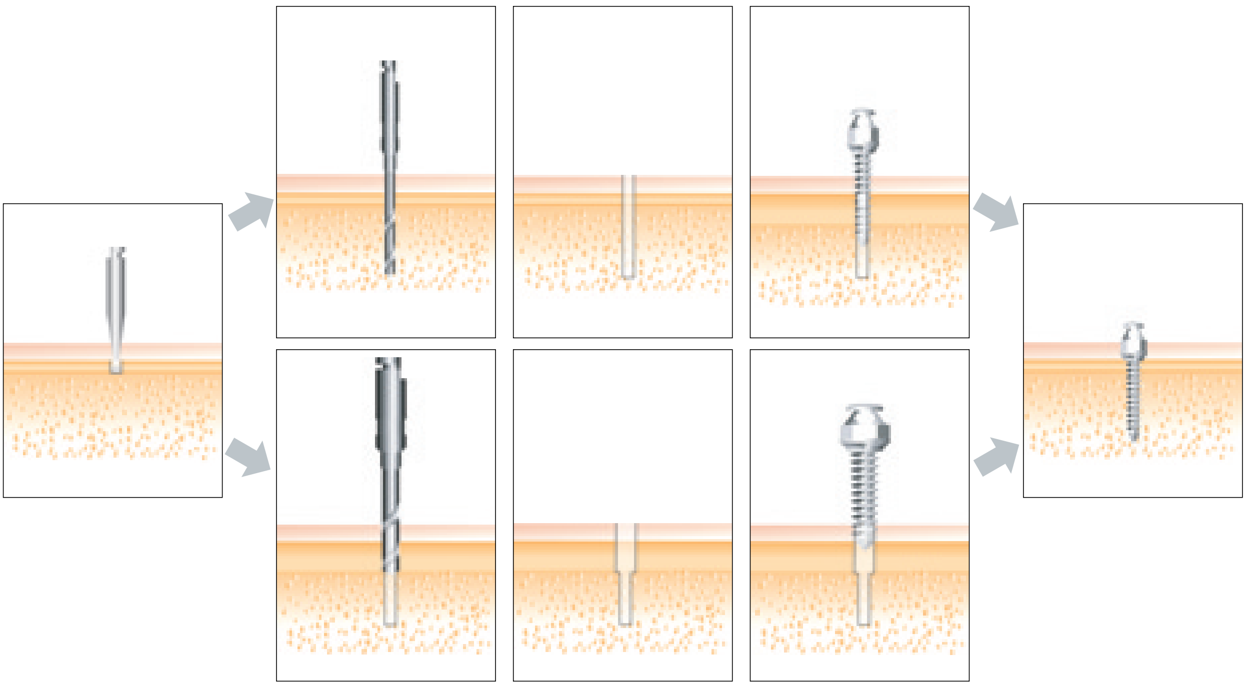


Fig. 5. One-step (upper) and two-step (lower) self-tapping procedures. When the cortical bone is too dense, it is better to redrill the cortical bone with a slightly larger sized drill (lower).

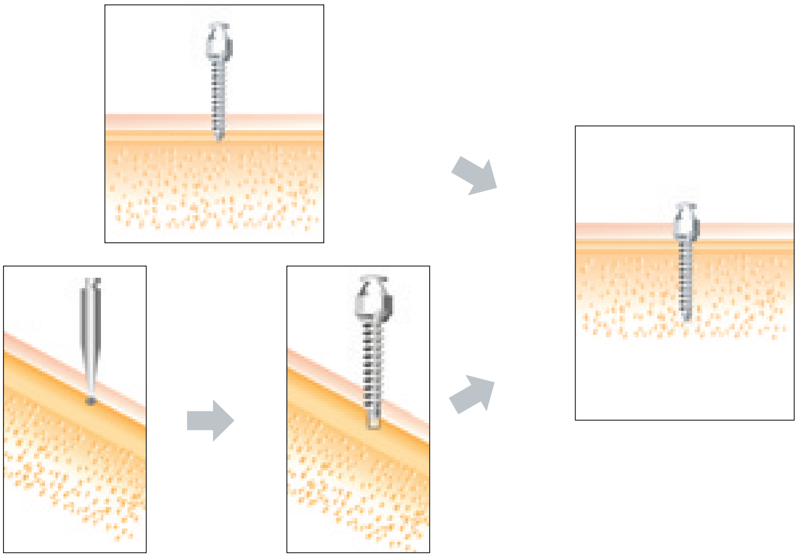


Fig. 6. One-step (upper) and two-step (lower) self-drilling procedures. When the microimplant is inserted in a diagonal direction, it is better to make an indentation first in the cortical bone using a round bur (two-step protocol) to prevent slippage of the microimplant during driving.

3) According to the path of Microimplant insertion (Fig. 7)

(1) Diagonal (or oblique) direction

When the microimplant is inserted into the bone in a direction oblique to the bone surface. This method can be used when the interradicular space between the teeth is very narrow. The microimplant is inserted at an angle of 30~60° to the long axes of the teeth, both buccally and lingually. Such angulated placement can reduce the risk of contacting the tooth root during implant placement.

(2) Perpendicular direction

When the microimplant is inserted into the bone in a direction perpendicular to the bone surface. Although this direction of insertion is the easier of the two, it can be used only when there is sufficient space between the roots of the teeth.

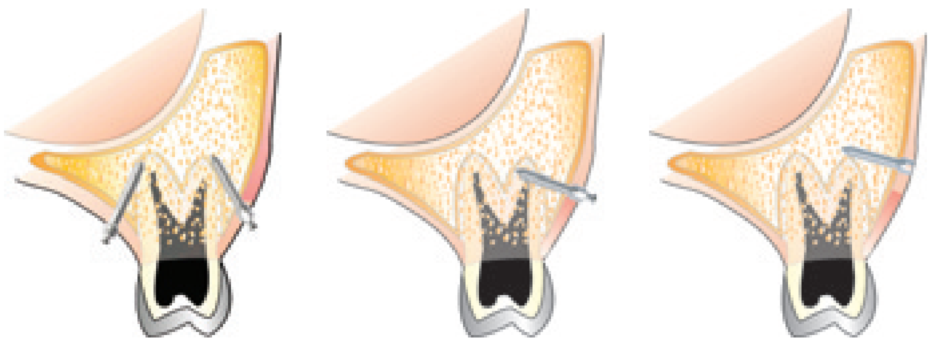


Fig. 7. Diagonal (left) and perpendicular (middle & right) insertion of microimplants.

5. Various clinical sites for Microimplant placement.

The followings are our recommended guidelines of microimplant sites and recommended sizes for orthodontic anchorage purpose.

1) In Maxillary zone

(1) Infrazygomatic crest area (Fig. 8)

Purpose : Retraction of the entire maxillary or the anterior dentition.
Intrusion of the maxillary molars.
Recommended Microimplants : Diameter : 1.3 & 1.4mm, Length : 5 & 6mm

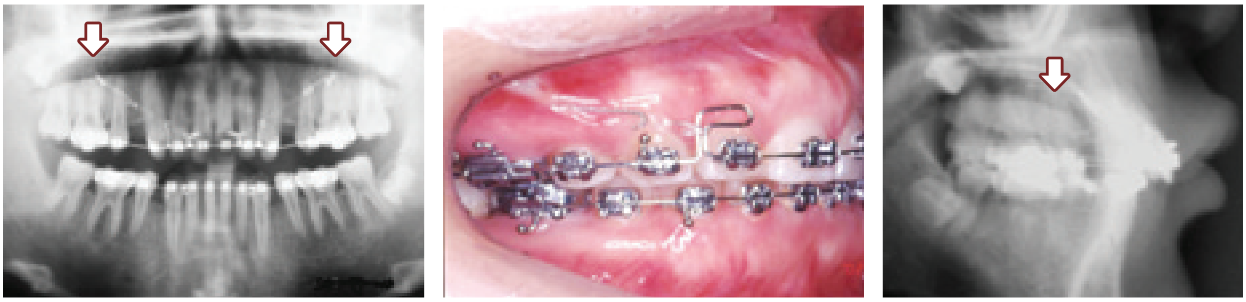


Fig. 8. Microimplants placed on the infrazygomatic crest area.

(2) Maxillary tuberosity area (Fig. 9)

Purpose : Retraction of the maxillary posterior teeth.
Recommended Microimplants : Diameter : 1.3 ~ 1.5mm, Length : 7 & 8mm

Fig. 9. Microimplants placed on the maxillary tuberosity area in lingual orthodontic treatment.

(3) Between the maxillary 1st & 2nd molars buccally (Fig. 10)

Purpose : Retraction of the maxillary anterior teeth.
Intrusion of maxillary molars.
Recommended Microimplants : Diameter : 1.2 & 1.3mm, Length : 7 & 8mm

Fig.10. The inter-dental microimplants in between the maxillary 1st & 2nd molars. The hook of the 1st molar tube is used to prevent gingival impingement of the coil spring (right).

(4) Between the maxillary 1st molar & 2nd premolar buccally (Fig. 11 & 12)

Purpose : Retraction of the maxillary anterior teeth.
Intrusion of maxillary buccal teeth.
Recommended Microimplants : Diameter : 1.2 & 1.3mm, Length : 7 & 8mm

Fig.11. The mesio-buccal root of the maxillary 1st molars are sometimes curved mesially. To avoid root injury, drill the bone somewhat mesial to the contact point between the 2nd premolar & 1st molar. Arrow : A fractured microimplant due to root contact during driving (Osteomed Co., dia : 1.2mm).

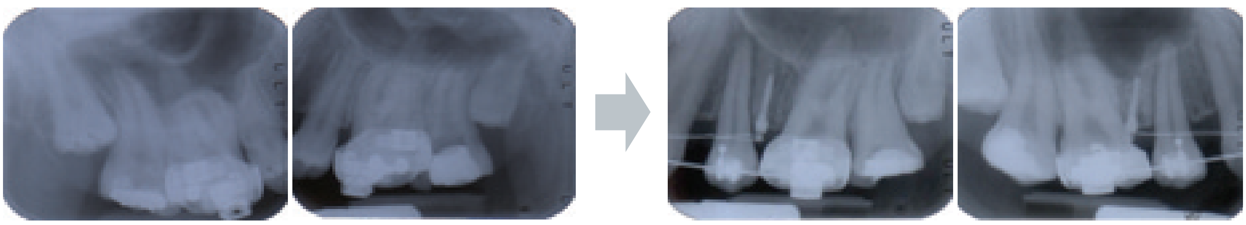


Fig.12. If the space between the roots is very narrow, the microimplant can be placed after making adequate space by moving the roots. If the wall of the maxillary sinus is very low, also, space can be made first and then the microimplant can be placed in a more perpendicular direction rather than in an oblique direction.

(5) Between the maxillary canine & premolar buccally (Fig. 13)

Purpose : Distal & mesial movement of maxillary molars.
Intrusion of maxillary buccal teeth.
Recommended Microimplants : Diameter : 1.2 & 1.3mm, Length : 7 & 8mm

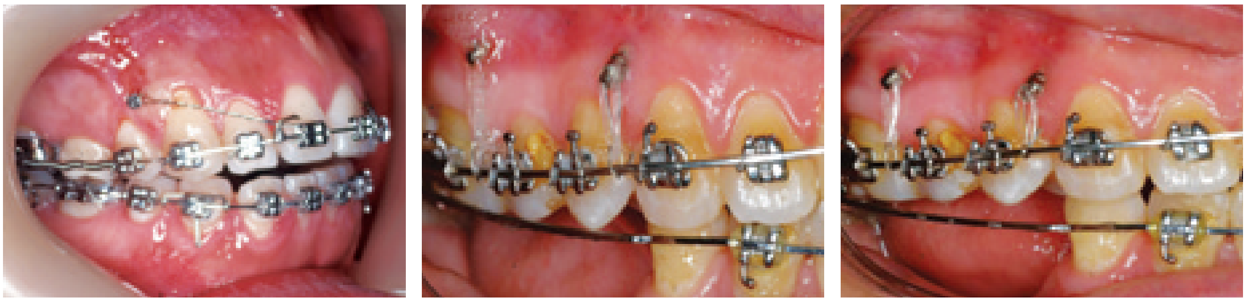


Fig.13. The microimplants in between maxillary canine & 1^{st} premolar to move molar distally (left). Maxillary buccal segment was intruded after 2 months (center & right).

(6) Between the maxillary incisors facially (Fig. 14)

Purpose : Intrusion & torque control of maxillary incisors.
Recommended Microimplants : Diameter : 1.3 ~ 1.6mm, Length : 6 & 7mm

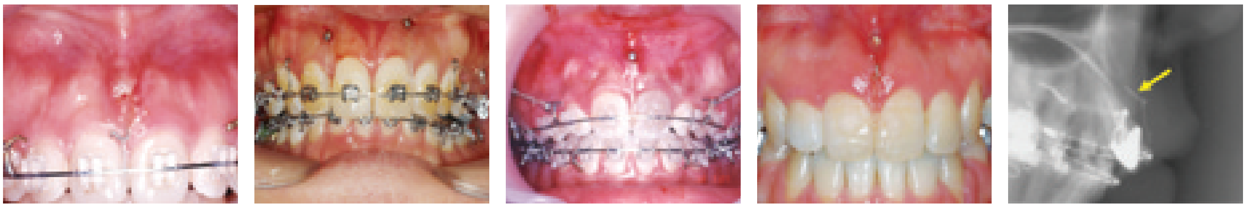


Fig.14. The microimplants between maxillary incisors.

(7) Between maxillary 2^{nd} premolar, 1^{st} molar & 2^{nd} molars palatally (Fig. 15)

Purpose : Retraction of the maxillary anterior teeth (Lingual ortho. Tx.).
Intrusion of maxillary molars.
Recommended Microimplants : Diameter : 1.3 ~ 1.6mm, Length : 10 ~ 12mm

Fig.15. Palatal implants for *en masse* retraction in lingual treatment (left). Molar intrusion (2 months) by combination of palatal and buccal microimplants (courtesy of Dr. Alfredo Alvarez).

(8) Mid palatal area (Fig. 16)

Purpose : Unilateral constriction.
Molar movement with Transpalatal arch.

Recommended Microimplants : Diameter : 1.5 ~ 2.0mm, Length : 6 & 7mm

Fig.16. Microimplants on the mid-palatal area.

Excellent implant sites in the maxilla are below the anterior nasal spine and in the midline of the palate. These areas contain very good quality of cortical bone. However they do have the osseous sutures too. So when we place the microimplant into the suture area, it's better to choose a little thicker microimplant. However, if the bony resistance of suture area is not enough, we can shift the microimplant adjacent to suture.

2) In Mandibular zone

(1) Retromolar area (Fig. 17 & 18)

Purpose : Uprighting of tilted mandibular molar.
Retraction of the mandibular teeth or whole dentition.

Recommended Microimplants : Diameter : 1.4 ~ 1.6mm, Length : 6 ~ 10mm

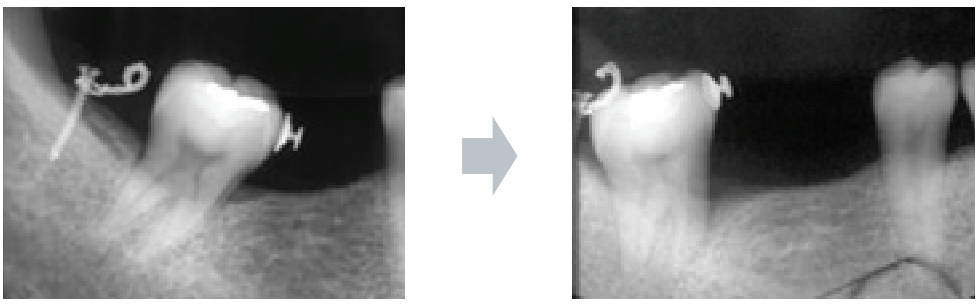


Fig.17. Microimplant in the retro-molar area for uprighting molar.

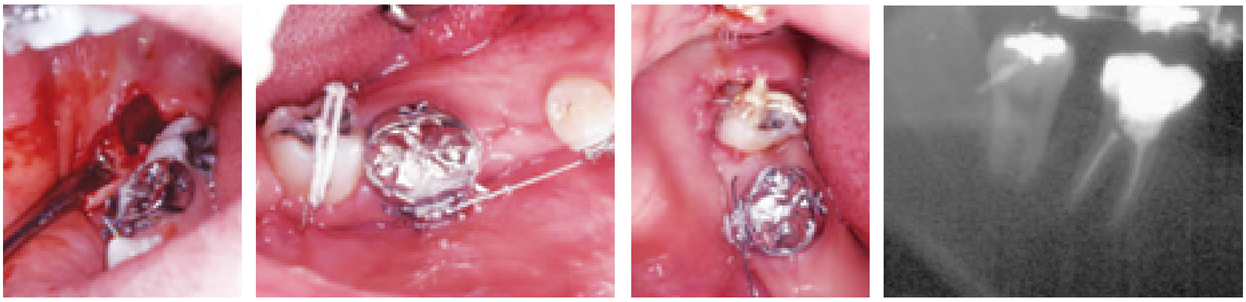


Fig.18. Microimplant used for lingually tipped 2nd mandibular molar. It can be placed in the same surgical procedure of extraction of third molar.

(2) Between the mandibular 1st & 2nd molars buccally (Fig. 19 & 20)

Purpose : Retraction of mandibular anterior teeth.
Intrusion & distal movement of the mandibular molars.
Recommended Microimplants : Diameter : 1.3 ~ 1.6mm, Length : 5 ~ 7mm

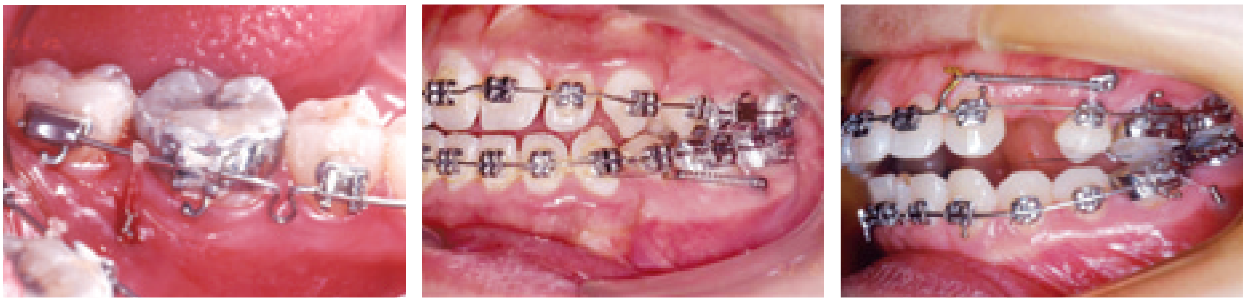


Fig.19. The microimplants between the mandibular 1st & 2nd molars buccally.

Fig.20. Microimplants for uprighting lingually tipped mandibular molars.

(3) Between the mandibular 1st molar and 2nd premolar buccally (Fig. 21)

Purpose : Retraction of mandibular anterior teeth.
Intrusion of mandibular buccal teeth.

Recommended Microimplants : Diameter : 1.3 ~ 1.6mm, Length : 5 ~ 7mm

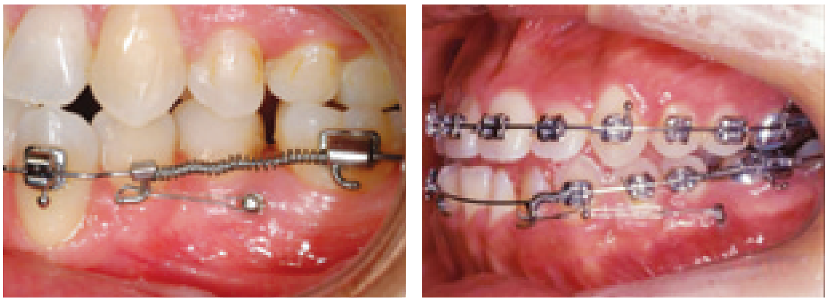


Fig.21. The microimplants between the mandibular 1st molar & premolar buccally.

(4) Between the mandibular canine & premolar buccally (Fig. 22)

Purpose : Protraction of mandibular molars.

Recommended Microimplants : Diameter : 1.3 ~ 1.6mm, Length : 5 ~ 7mm

Fig.22. Microimplants between the mandibular canine & 1st premolar.

(5) Mandibular symphysis facially (Fig. 23)

Purpose : Intrusion of mandibular anterior teeth.

Recommended Microimplants : Diameter : 1.2 ~ 1.4mm, Length : 5 & 6mm

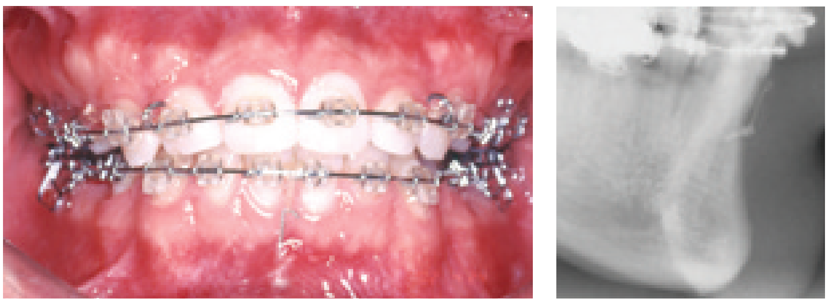


Fig.23. Microimplants placed in the mandibular symphysis.

(6) Edentulous area (Fig. 24)

Purpose : Controlling the adjacent teeth of edentulous area including molar uprighting, distalization, mesialization, intrusion, extrusion & torque (*using Two microimplants)

Recommended Microimplants : Diameter : 1.3 ~ 1.6mm, Length : 7 & 8mm

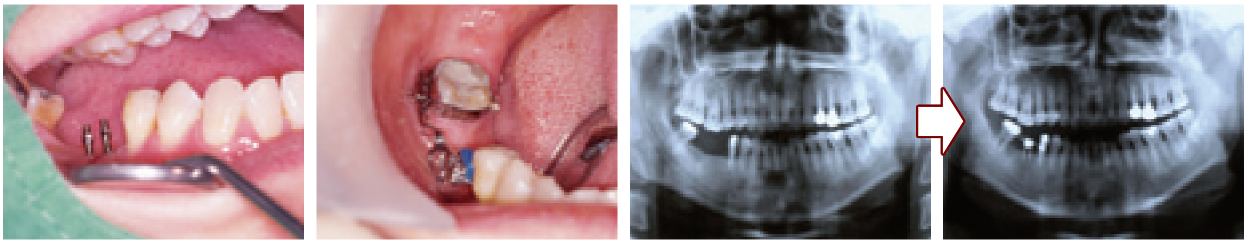


Fig.24. Two microimplants are placed in the edentulous area for bracket attachment. And sectional edgewise wire was used to protract 3^{rd} molar 3 dimensionally.

3) Others (Fig. 25)

The Absoanchor® microimplant system is available in variable sizes and lengths of screws for orthodontic anchorage. It can be used in any area of the mouth, if there is a bone. For example, the mandibular tori and the bone adjacent to residual roots that will be extracted at a later date can be used for the placement of the microimplants.

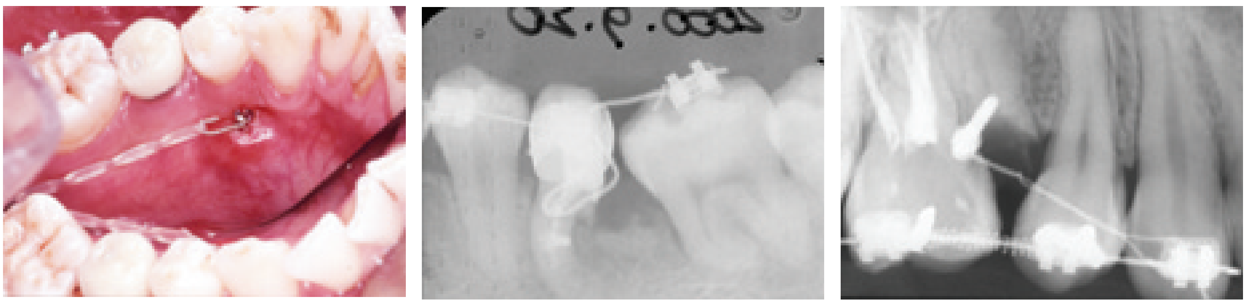


Fig.25. A microimplant which are placed on a torus (Lt) & into roots (Mid & Rt).

6. Surgical Procedures

1) Anesthesia

Small amounts of local anesthetic are sufficient for the simple surgical procedure to insert the Absoanchor® microimplant. It is not necessary for the clinician to achieve profound anesthesia of the teeth; rather only the soft tissue need be anesthetized. Sometimes, **only topical anesthetic agent** (Dentipatch®, Painless patch®, Lidocaine spray etc) **is enough** for microimplant placement. If the patient feels some sensitivity during drilling or microimplant driving, that sensation is a sign of the microimplant touching the roots – the drill can be redirected away from them. Only one-fourth to one-third of a local anesthetic carpule is needed for this type of anesthesia.

When anesthetizing the palatal mucosa, the needle also can be used to probe and measure the mucosal thickness, which helps to determine the screw length necessary for anchorage (Fig.26). When the palate is anesthetized, the positions of the greater palatine artery and nerve should be reviewed so as to avoid injuring them.

When planning the use of one or more microimplants in extraction patients, the microimplants can be placed just before the teeth are removed. Combining microimplant placement and tooth extraction at the same appointment obviates the need for an additional surgical procedure.

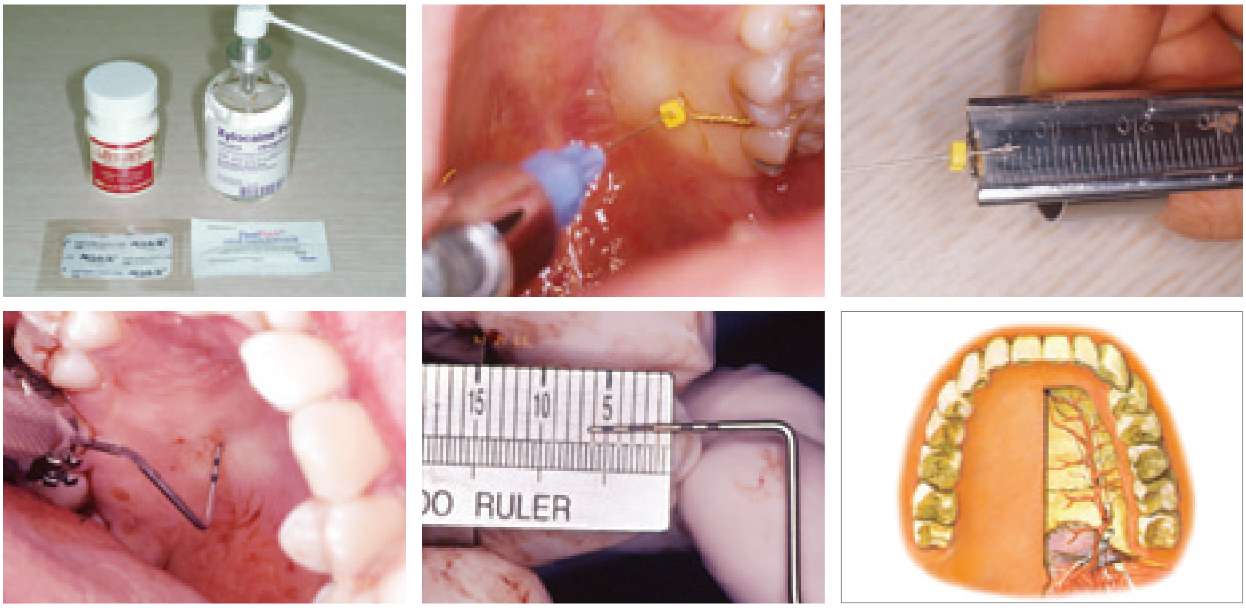


Fig.26. Sometimes, only topical anesthesic agent is enough for microimplant placement. Palatal mucosa varies greatly in thickness, which requires measurement during or after local anesthesia in order to select the proper length microimplant. Review the positions of the greater palatine artery and nerve so as to avoid them.

2) Aseptic Preparation

Zepherin® (benjalkorium chloride) sponge or other common disinfecting agent can be used to prepare an intraoral & extraoral scrub for keeping the surgical area aseptic.

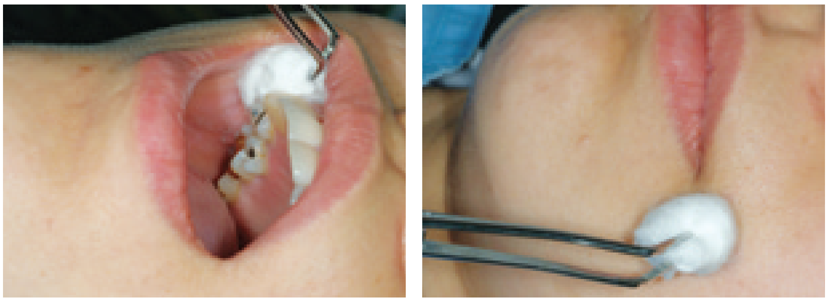


Fig.27. Aseptic intraoral and extraoral preparation with disinfecting agent.

3) Drilling

Mark the implant sites by using brass wires as shown in Figs. 26 & 31. Clinicians will ordinarily use a speed-reduction contra angle hand piece (64:1) to make the original entry into the bone (Fig.28). However, when the drill shank is slightly too large for the hand piece, it can be electropolished to reduce and made to fit (Fig. 28).

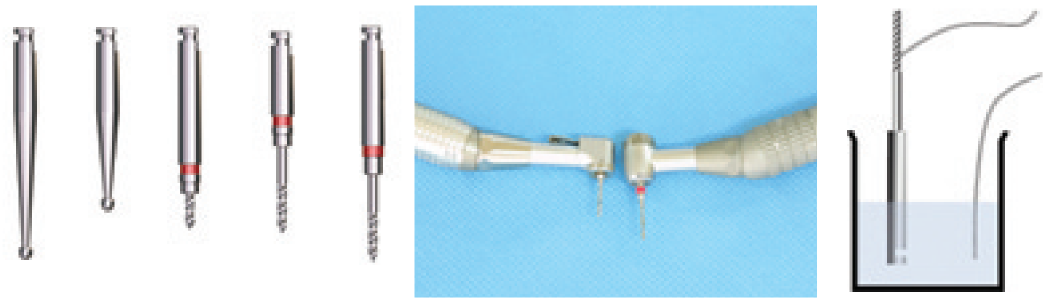


Fig.28. Various types of drill bits (left) and speed-reduction contra angles : 64:1 (middle). When the bur does not fit into the speed-reduction contra angle hand piece smoothly, electro polish the bur shank until it does (right).

Before using the pilot drill, use a #2 round bur (0.9mm diameter) first to make a small indentation on the bony surface. Round bur also can penetrate attached gingiva directly to the bone. Small indentation on the bone surface can prevent slippage of pilot drill especially when we drill diagonally and also can make a hole on the bone surface more easily when we encounter extremely dense cortical bone. Round bur also can help to reduce the blunting of pilot drill, due to repeated use. Moreover the pilot drill is much more expensive than the bur.

Drill-free method can be used when a larger diameter pure titanium microimplants or microimplants that are made of titanium alloy.

However, clinicians should avoid trying to self-drill with the microimplant itself (Fig. 6) especially while using smaller diameter microimplants (less than 1.5mm) that are made of low grade pure titanium, since this may lead to metal fatigue and subsequent screw fracture. While using low grade pure titanium microimplants of smaller than 1.6mm diameter, beginners should at least penetrate cortical bone initially, before attempting self drilling procedures. Usually, it is recommended to extend the drill to the full length of the screws, while using a smaller diameter of microimplants.

The diameter of the drill end should be at least 0.2/0.3mm smaller than that of the selected microimplant. Before beginning the surgical penetration, the clinicians should check the drill to ensure if it has no unwanted bends in the shaft, that might cause it to wobble while drilling, resulting in unduly enlarge the opening. The microimplant depends almost entirely upon mechanical retention within the bone and must have a little tight fit to avoid jeopardizing its retention.

The drill can penetrate the mucosa, attached gingiva and underlying bone without the benefit of a surgical flap (Fig. 29). However, when making an entrance around movable soft tissue, a small vertical incision (less than 4mm) will prevent a soft tissue roll-up around the drill (Fig. 30).

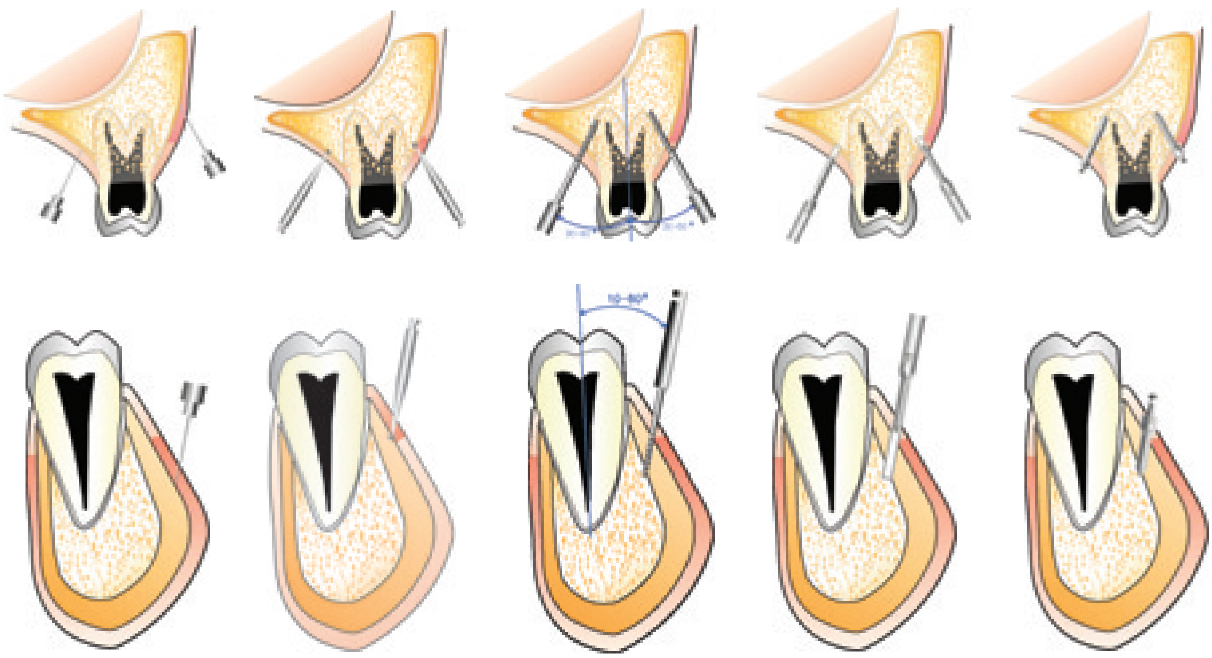


Fig.29. Maxillary and mandibular micro-implant applied to attached gingiva (self-tapping method).

Fig.30. Vertical incision is needed when microimplant applied to maxillary and mandibular movable soft tissue (self-tapping method).

Fig.31. Construction of a indirect drill guide.

A beginner can make a indirect drill guide like Fig. 31 for more precise drilling.

A slow drill speed (400-500 RPM) with water irrigation reduces the heat and keeps the surgical site lubricated. Faster drill speeds up to 30,000 RPM will work, but clinicians run the risk of creating too much heat, which can cause osseous necrosis. When drilling into dense cortical bone, careful up and down as well as stop and go strokes will compensate for the heat generated during drilling.

The microimplant sites in the maxilla need to have a 30-60 degree angulation to the long axes of the teeth, both buccally and lingually (Fig. 29). Such angulation augments the surface area contact between the microimplant and the cortical bone and also increases retention while lowering the risk of touching a root.

Generally, mandibular bone has a thicker cortex than that of the maxilla, and this allows a reduced angulation of 10-60 degrees for the mandibular microimplant (Fig. 29). Nevertheless, doctors should remember that cortical bone densities and volumes will vary from patient to patient and from side to side, even in the same patient.

A final surgical caveat-do not use excessive force with the drill. Any great resistance after passing through the cortical plate is probably due to root contact, and then the drill angulation needs to be changed.

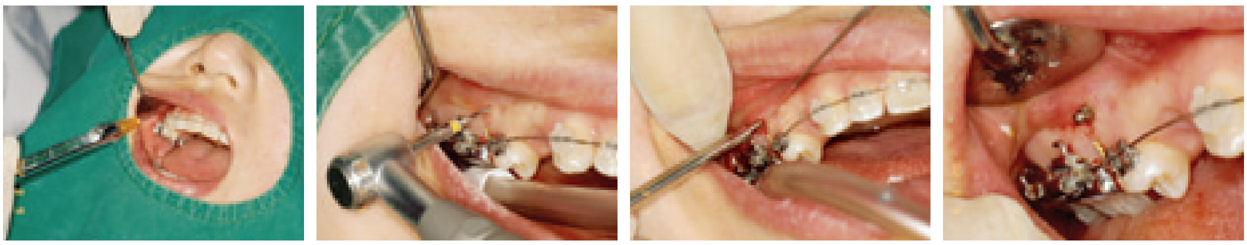


Fig.32. Maxillary microimplant applied to attached gingiva (self-tapping method).

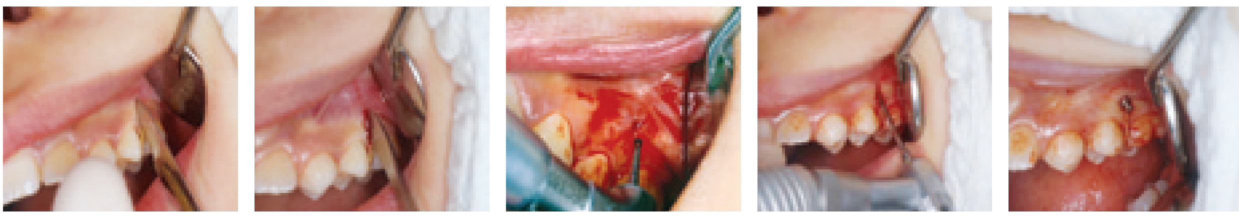


Fig.33. Maxillary microimplant applied to movable soft tissue with a surgical incision and self-tapping method.

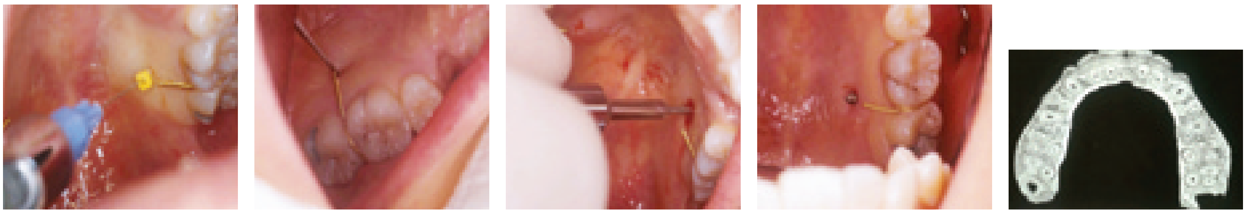


Fig.34. Maxillary microimplant applied to palatal mucosa with a self–tapping method. Note that more space exists between palatal roots than buccal ones.

Fig.35. Mandibular microimplant applied to attached gingiva (self–tapping method). Note the thickness of the cortical bone in the mandibular buccal area.

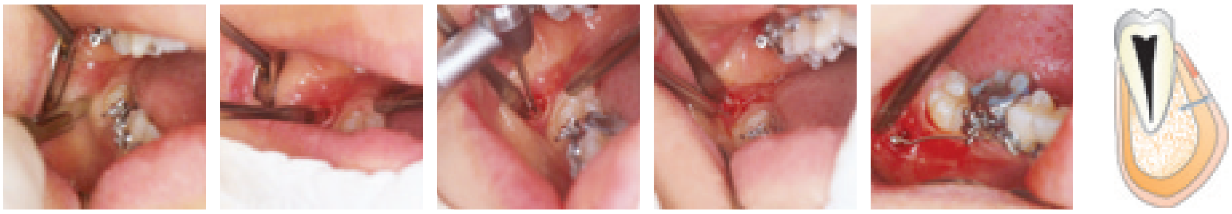


Fig.36. Mandibular microimplant applied to movable soft tissue with a surgical incision and a self–tapping technique.

Fig.37. Two types of self–drilling procedures. One–step (above) & two–step self–drilling procedures after round bur indentation(below).

7. Advice for Microimplant driving

There are 2 types of driver : hand drivers & engine drivers (Fig. 38).

Hand drivers have two sizes depending on their length; Long and Short one. Long hand driver is used for driving the microimplant on the buccal surface of both the arches. The Short hand driver is used for driving the microimplant on the palate or retromolar area.

Engine drivers have 4 different sizes depending on the length. When we use engine driven technique we have to reduce the engine speed to less than 30 rpm, with torque force of less than 70% of torque-resisting force of the chosen microimplant (Fig. 41). We can use 256:1 speed reduction contra-angle hand piece for engine driven techniques. There are four sizes of engine drivers, so they can be chosen depending on the intra oral condition of accessibility. When we use engine driven technique, it is often easier to drive the microimplant in the bone. However, it is surely safer to use a hand-driver, so that clinicians can feel any resistance from hard cortical bone or roots and make needful adjustments to avoid the microimplant fracture during driving.

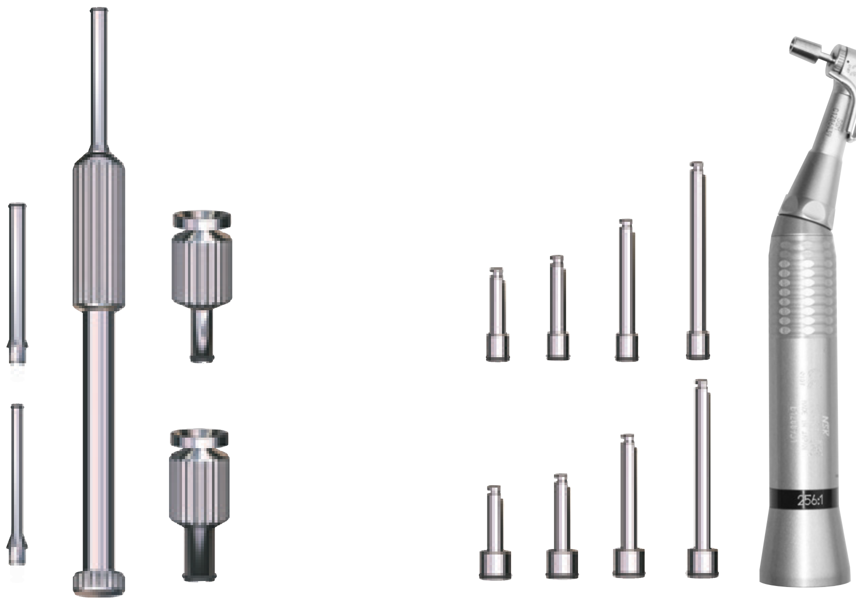


Fig.38. Two kinds of Hand drivers (left). Speed reduction contra angle (256:1) & engine drivers (right).

To prevent breakage of microimplant during driving, a hand driver with a built-in torque restrain has been developed (Fig.39). The smaller size of titanium microimplant (1.2 & 1.3mm diameter) can be broken, if we apply torque forces that are more than 1Kg.cm. However, usually less than 0.5Kg.cm is more than enough to get initial mechanical tightness. So in order to prevent breakage of microimplants while driving, we have to know the maximun tolerable torque-resisting force of microimplants that we are using, to load them accordingly. Fig. 40 shows the torque resisting force of titanium alloy microimplants (Dentos Inc.) in relation to their diameters.

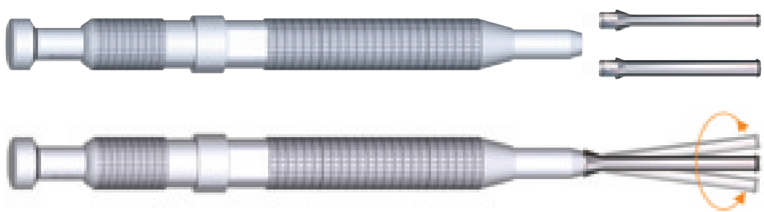


Fig.39. Newly developed long hand drivers with torque gauge. The torque force can be adjusted from 0.5Kg.cm to 2Kg.cm.

Fig.40. Sterilization package for Absoanchor® microimplant (left). The package can be cut with scissors just before use and the driver can engage the microimplant in its package (middle & right). Do not touch the microimplant part with fingers.

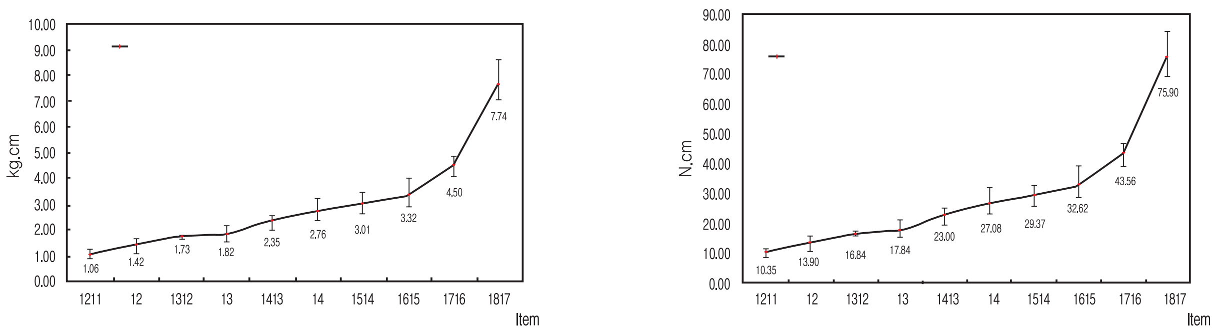


Fig.41. The torque resisting force of microimplants of Dentos Inc. (Daegu, Korea) depend on the diameters. (*1kg=9.8N)

If a microimplant touches the root during driving, we can feel the increased resistance to its easy passage and often patients will complain of dull pain, if we do have shallow anesthesia. In these situations, we can redirect the microimplant after redrilling or we can choose a shorter length of microimplant with a size larger in diameter (rescue microimplant). Slight injury to the root surface by the microimplants is not so harmful to teeth, but root contact of microimplant is one of the main reasons for the failure of the implants. The masticatory forces inducing the mobility of the tooth as well as the microimplants that are in contact with these roots, which eventually results in the loosening of microimplants.

Light forces (less than 0.7Kg.cm) can avoid microimplant fracture, so when an operator encounter resistance, we should withdraw the implant, and then re-drill the bone with the next larger drill and then resume the microimplant driving. For example, if we used 0.9 mm diameter of drill at first time, then we use 1.0mm diameter of pilot drill for redrilling. At this time, redrilling should be done only in the cortical bone area (Fig. 6 : Two-step drilling).

To reiterate, success with microimplants depends upon initial tightness. So, before drilling, we have to check the straightness of drill and also it's ability to not to vibrate the long axis of pilot drill during drilling. If there is no initial mechanical tightness of the microimplant after placement, choose one size larger microimplant. When such tightness does not occur, replace the implant with the next larger size. Occasionally, a new site adjacent to the original one may need preparation.

8. Avoiding root damage.

The proximity of microimplants to the roots of teeth present orthodontists with an important challenge, they must use extreme care to avoid roots as they position the implant. Serial periapical X-rays taken by tube shift technique can help determine if adequate space exists for the implant between teeth. CT scans offer 3-D images for precise interpretation (Fig. 41), but this brings up the issues of radiation hygiene and extra expense. To date root damage has not presented too many problems. Roots typically demonstrate good recuperative power, even when severely challenged as it happens during apicoectomies. The day after placing microimplant, patients will complain of a dull pain during mastication, if a microimplant comes in contact with a root, but moving the root away from the implant will usually relieve this discomfort. However, occasionally there are no adverse signs and symptoms whilst the root comes in contact with the microimplant, by virtue of their own movement. Thus a diagonal path of microimplant insertion will help to avoid root injury when we place the microimplant between roots. If there is not enough inter-radicular space, we can move the roots apart orthodontically before placing the implants (Fig. 12).

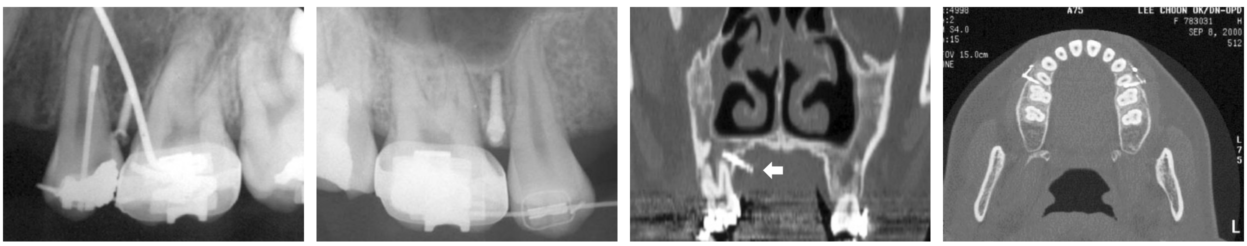


Fig.42. Review root approximation by microimplant with a periapical radiograph or CT scan.

9. Orthodontic Force application

Theoretically, we have to wait 2-3 months for osseointegration between titanium surface and bone tissue. Also, it's better to wait about 2 weeks for soft tissue healing before applying orthodontic force when we do use stab incision for implantation. However, when we attempt distraction osteogenesis (DO), we do not wait for osseo-integration between screw pin and bone before force application. Similarly we can commence immediate loading after implantation, if needed. Actually, there was no clinical differences in failure rate between immediate loading and delayed loading, if we keep the applied the force to less than 300gm. We do infer that the mechanical stability is far more important than osseointegration in microimplant anchorage systems. Light continual forces as generated by nickel titanium coils are more favored over chain elastomerics that often have excessive initial forces.

10. Postoperative patient management

Usually there is little to report about noticeable pain or side effect like infection after microimplant placement. Although patients seldom need any medication for pain, doctors should make prescriptions of antibiotics and other pain-killing drug available for them on a needed basis.

Microimplant sites will require excellent oral hygiene with soft brushing and possibly water irrigation. From time to time chemotherapeutic rinses may ward off inflammation and infection.

11. Microimplant removal

Fortunately, strong osseointegration does not occur between microimplant and bone, and this simplifies the removal of these microimplants. In the open method, clinician can engage the microimplant head with the driver and turn it in the opposite direction of the insertion that will easily remove it. What is more, local anesthesia is not needed during this procedure. Patients may have some minor discomfort when the implant irritates the soft tissue while its removal, but this gives far less discomfort than an anesthetic needle-prick. In the closed method, we need small incision over the head portion of microimplant to expose it, after local anesthesia. The initial turn, sometimes does offers some resistance, so, use caution with the first turn so as not to break the microimplant.

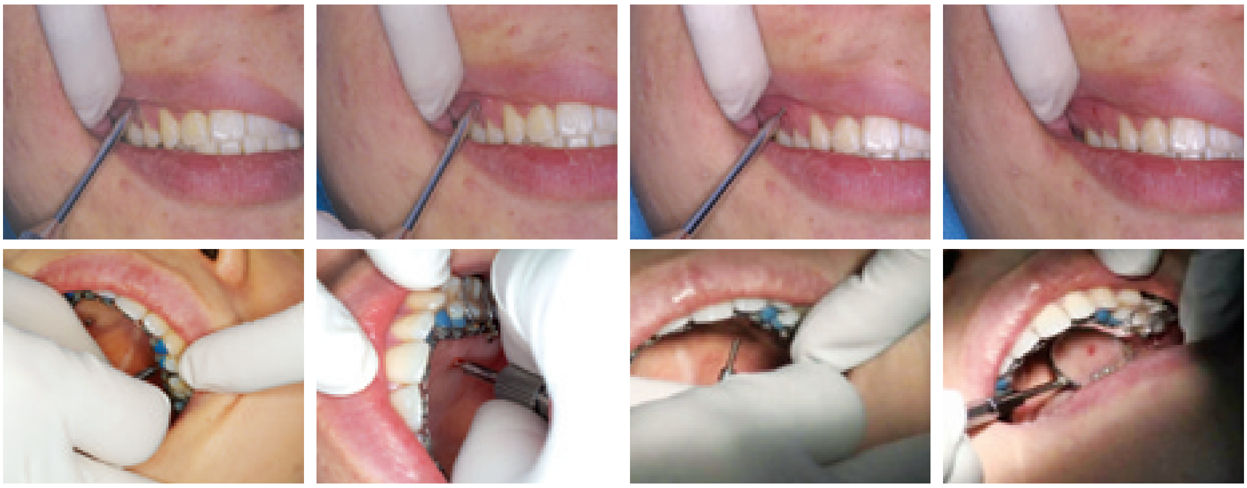


Fig.43. Removal of microimplant (Absoanchor®, Dentos Inc.) using hand driver on the buccal surface of maxilla (upper row) and the palate (lower row). There is no need of needle-stick anesthesia for it's removal. Only a topical anesthesia is recommended.

Fig.44. Removal of microimplant using a speed reduction engine driver on the palatal surface without needle-stick anesthesia.

12. Limitations

Successful microimplantation depends on several features :

∗Clinician's skill ;
∗Patient's physical condition ;
∗Site selection ;
∗Patient's oral hygiene.

Although only a small number of microimplants fail, patients should be warned about such a possibility. Nevertheless, inflammation decreases dramatically when the implants are inserted in the areas of attached gingiva. Occasionally, even tight microimplants loosen from subsequent inflammation, so excellent patient's oral hygiene with proper soft brushing and frequent irrigation will greatly increase the chances of success.

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