

Hee-Moon Kyung

- Clinical instructor, Department of Orthodontics, Dental School, Kyungpook National University, Daegu, Korea (1986).
- Visiting Professor, Department of Orthodontics, Osaka University, Japan (1991-1992).
- Visiting Professor and Associate Professor, Department of Orthodontics, British Columbia University, Canada (1996-1997).
- Director of the Dental School at Kyungpook National University, Daegu, Korea (2001-2003).
- Vice-President of the Lingual Orthodontics World Association (2003).
- Head of the Department of Orthodontics, Kyungpook National University, Daegu, Korea (2004).
- Author and Co-Author of more than 100 scientific papers, most of which international.
- Author of the book "Longitudinal Data of Craniofacial Growth from Lateral Cephalometrics in Koreans with Normal Occlusion".
- Contributed to the Craniofacial Growth Series book "Micro implants as Temporary Orthodontic Anchorage", published by James Mc Namara Jr. in 2007.
- Married to Myung-Hee Kim, lives in Daegu, third largest city in Korea, and has three children. The daughter, aged 25, after graduating from the Seoul University Administration Course, enrolled at the Kyungpook National University Dental School in Daegu where she is currently attending her last semester. The son, 23 years old, is currently attending the last academic year of the Food Engineering course at the same University. Dr. Kyung played many different sport modalities while he was a student but today he is a Golf player, with a handicap of 1.



One of the most important aspects of orthodontic treatment is anchorage control. Just as the materials used in the manufacture of fixed appliances have changed from gold to stainless steel, from the use of bands to direct bracket bonding, so have anchorage devices evolved in response to the need to increase resistance to undesirable tooth movements. Among the resources developed for anchorage, miniplates and mini-implants are among the best suited devices and have, accordingly, earned widespread acceptance in the current literature. Dr. Hee-Moon Kyung is one of the professors who have most significantly contributed to developing mini-implants around the world. He is the author of *Microimplants in Orthodontics*, a book comprising detailed protocols used by the eminent professor and his colleagues. We had the pleasure to talk with Dr. Kyung, who kindly granted the following interview to Dental Press and its readers.

Carlos Jorge Vogel

Why is the success rate of microimplants in the maxilla higher than in the mandible, where bone density is much higher. Telma Martins de Araújo

Prosthodontic implants show higher success rate in the mandible than in the maxilla. On the other hand, microimplants happened to result in more failure in the mandible, which has higher bone density. Still, the exact reason is unknown.

However followings are suspected reasons according to my experiences;

- 1) more likely to touch root when lesser buccal alveolar bone volume exists as in the mandible
- 2) narrower attached gingiva in the mandible can induce more inflammation and also higher possibility of touching root
- 3) thick cortical bone in the mandible may generate more heat when drilling is needed
- 4) thick cortical bone in the mandible can induce more microfractures, local ischemia & necrosis around microimplant except for pre-drilling method
- 5) mandibular buccal bone receive more external force from mastication since mandibular buccal cusps are functional cusps

Is the success rate of microimplants influenced by the diameter and length of the microimplants? Fábio Bezerra

Theoretically the bigger and the longer ones may have good retention. However, according to many clinical data, the bigger and the longer diameter does not always guarantee higher success rate. One clinical data¹ from Japan shows that the success rate of smaller diameter (1.3mm) of microimplants is higher than larger (2.0 and 2.3 mm diameter) ones, and even higher than miniplate. Also longer microimplants can have a limitation due to anatomical problems, but we have to insert the microimplant at least 5-6mm into the bone.

Are microimplants with diameter of 1,4mm more prone to complications, such as fractures, during the act of installation or at re-

moval? Telma Martins de Araújo

The smaller, the more possibility of fracture. On the other hand, the bigger, the more possibility of root touch and the more difficulty of removal. So, different size (both diameter and length) should be chosen depending on the sites.

Drill-free microimplants present higher rate of success than non-drill-free ones? Why? Fábio Bezerra

According to our experience, there is no difference between the pre-drilling and drill-free methods. The key point is to choose proper size of pilot drill. Personally I prefer pilot drill which diameter is 0.3mm smaller than that of microimplant.

What kind of protocol do you indicate in cases where radiografically you diagnose the contact of a microimplant with a root surface? Do you expect to see a deleterious effect by this contact? Carlo Marassi

I usually do not take any X-rays simply for checking the root touch after installation. But, these days I use dental fluoroscope (Dream Ray^o,^R, Korea), when I want to check the root touch.

Clinically, patient feels pain, if microimplant touch the root. So, I always try not to induce deep anesthesia. Sometimes just topical anesthesia is enough for microimplant placement.

According to Roberts² by animal experiment, simple root touch does not make any trouble. There is one data (not published yet) of intentional root injury in human from Turkey. According to this data, there was no deleterious side effects, such as ankylosis.

But more failures may be caused after microimplant touched the root. There is one scientific data³ from Japan which support this hypothesis.

Which were the worst complications you had and how did you solve them? Jorge Faber

Fortunately, I have never experienced heavy complications except loosening of microimplants due to inflammation. In these cases, there is no problem after loosened microimplants are being

removed. I do not prescribe any antibiotics before & after installation.

However, followings are common possible complications;

- a. root penetration: when using too large diameter of microimplant without drilling
- b. fracture: when using smaller diameter of microimplant without drilling ; we do not try to remove it when it is hard to remove
- c. injury to anatomical structures, such as maxillary sinus, inferior alveolar nerve & artery, greater palatine artery & nerve.

Are there specific indications for the use of microimplants with a bracket head, and up to how much of moment/force can they resist?

Carlo Marassi

Bracket head type is preferred when indirect skeletal anchorage and moment from the microimplant are needed. It is easier to change the direction of force by connecting wire to the microimplants.

Initial tightening torque force varies depending on the diameters of microimplants, quality of cortical bone and installation method (pre-drilling and drill free) etc. According to my experience, when pre-drilling (1.0mm diameter drill) method is used with 1.3mm diameter of microimplant in the maxilla, the initial tightening force start from 3-4 N Cm. Without drilling, of course the force should be increased. However, the moment applied counter-clockwise direction to the microimplant will more likely to be loosened even by small amount of force. That's why I made left-handed screws.

In the treatment of CI II adult patients with extractions, where retraction of maxillary an-

terior teeth is planned with the use of micro-implant anchorage reinforcement, what kind of procedure do you favor, the extraction of premolars, or third molars?

José Nelson Mucha

For En Masse retraction of upper anterior teeth, the 1st choice of microimplant placement site is between 2nd premolar and 1st molar roots. This area has enough inter-radicular space, which makes easier to insert and less gingival impingement by elastomers, compared to placement between 1st molar & 2nd molar roots. There is no actual difference when making diagnosis about extraction of teeth compared with conventional diagnosis.

For premolar extraction case, I prefer to retract 6 anterior teeth together. What is more, even if you extract 3rd molars or 2nd molars, the whole dentition can be retracted without moving posterior segment first, when there is a mesial tipping of posterior segments. However, in cases with already uprighted molar teeth, it's more effective to move molar teeth first, and then retract remaining anterior teeth. When there is enough volume of bone, we can retract the whole dentition back without touching the 2nd premolar roots, if the microimplants are inserted in oblique direction.

Also, depending on the cases, we can insert microimplants on the tuberosity area as well.

Dr. Kyung, I believe that you are one of the most experienced clinicians in the use of microimplants. In your opinion, which are the most effective mechanics in order to obtain distal movement of maxillary molars in the correction of the CI II malocclusions?

Lincoln Issamu Nojima



FIGURE 1 -Molar uprighting using Bracket Head type microimplant of left handed screw (Dentos Inc., Daegu, Korea). (Treatment provided by Dr. Maria E. Cabana, Spain).

There are many ways to move maxillary molar teeth back. Some may prefer to use midpalatal microimplant with T-P bar. Personally, I do not like to use midpalatal microimplant because, it requires more caution for access to apply force and to control tooth movement clinically. I prefer both buccal & palatal alveolar microimplants to move molar teeth bodily.

Could you relate your experience in relation to the intrusion of posterior teeth in patients with vertical discrepancy? Are the results achieved by this procedure expected to be stable? Could they be a possible substitute for orthognathic surgery? Lincoln Issamu Nojima

Dr Sugawara in Japan has some data(not published yet) about this. According to him, the results were excellent and this can be a substitute for orthognathic surgery in some case. Also, long term stability is fair enough compared to normal openbite treatment without intrusion of posterior teeth using skeletal anchorage.

According to my experience, there is always a certain amount of relapse after treatment of openbite after intrusion of posterior teeth using microimplants. If we treat openbite patients with mesially tipped posterior teeth, we can have better stability.

Would you use microimplants for control of vertical growth in growing patients? Henrique Villela

If the microimplant is located in the maxillary bone, inhibition of maxillary growth is not expected. However, if the microimplant is placed on the other kinds of bone, such as zygomatic bone, sutural growth between zygomaticomaxillary suture could be inhibited. However, growth of circummaxillary suture will not be perfectly inhibited only to use intraoral force from microimplants to teeth and/or bone.

Anyhow, I do not use microimplants in young growing patients by reason of inhibition of growth because I think it's not a cost-effective trial. Also success rate of microimplants is low in growing patients.

In non-surgical CI III cases, where distal movements of mandibular teeth are planned with the help of microimplants, what kind of mechanical procedures are there available, or would you suggest? Jorge Faber

The mechanics is the same as in the maxilla. However, I prefer to place microimplants between 1st & 2nd molar instead of 2nd premolar & 1st molar for whole mandibular dentition retraction. The reason is that there is no enough alveolar

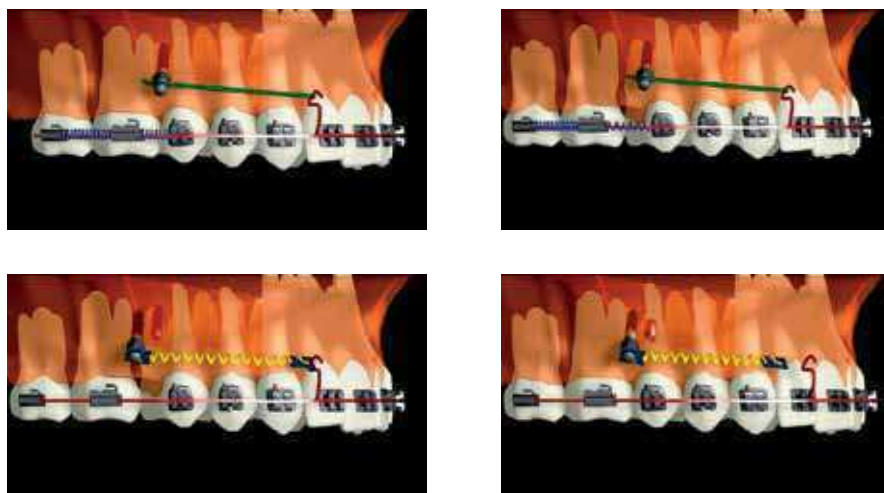


FIGURE 2 - Maxillary molar distalization mechanics. After molar distalization, if a microimplant touches the root of a maxillary second premolar during retraction of the maxillary dentition, the first microimplant is removed and a second microimplant is placed distal to the first one.

bone volume between the mandibular 2nd premolar and 1st molar roots to place microimplant with oblique direction.

We can retract whole dentition without moving posterior segment first, if mesial tipping of posterior segments exists. On the other hand, if molar teeth are already uprighted, it's more effective to move molar teeth first, and then retract the remaining anterior teeth.

Moreover, depending on the situations we can insert microimplants on the retromolar area also.

Could you give us your experience in cases of maxillary expansion with the help of microimplants? Henrique Villela

Long time ago, some dentists used skeletal anchorage for rapid maxillary expansion. I think it's a good idea. But, I have never tried to use skeletal anchorage for RPE, because just conventional RPE appliance is enough for growing young patient. Also, using of skeletal anchorage does not guarantee successful expansion of midpalatal suture in non-growing patients. It's not cost-effective too.

The use of microimplants created a new concept in orthodontic treatment. What do you imagine will be the next novelty involving a significant changes in treatment concepts? What can we expect in the future? What will come after the microimplants? José Nelson Mucha

The concept of using microimplants in orthodontic tooth movement has no difference com-

pared to conventional tooth movement. The only difference is that we can achieve almost all kinds of tooth movement more easily without patients' cooperation. By solving the problem of patient's cooperation (patients cooperation is a nature of orthodontics according to Dr Moyers) in intra-oral anchorage, predictable tooth movement is achieved.

Anyhow, using of microimplants made many kinds of orthodontic tooth movement which were thought to be difficult, such as molar intrusion and whole mandibular dentition retraction, easier & more predictable without patient's cooperation and related side effects. Many minor tooth movements for interdisciplinary treatment (prosthodontic-ortho & periodontic-ortho cases) became simpler. In addition, some surgical cases can be treated without surgical intervention and some two jaw surgery cases can be treated with only one jaw surgery.

However, still we cannot use microimplants for fixed functional appliance (eg. Herbst appliance etc.) because microimplants can be loosened in young growing patients. But in the near future, I am looking forward to using skeletal anchorage for fixed functional appliances, too.

By use of microimplants, we can solve most of the anchorage problems. However, the speed of biological tooth movement is not yet improved, even though many researchers struggled for several decades. In the near future, I hope that we can have some local agents which make rapid tooth movement in specific area.



FIGURE 3 - Both buccal and palatal Bracket Head type of microimplants are placed for bodily distalization of maxillary molar teeth.



FIGURE 4 - Initial records of skeletal open bite case.

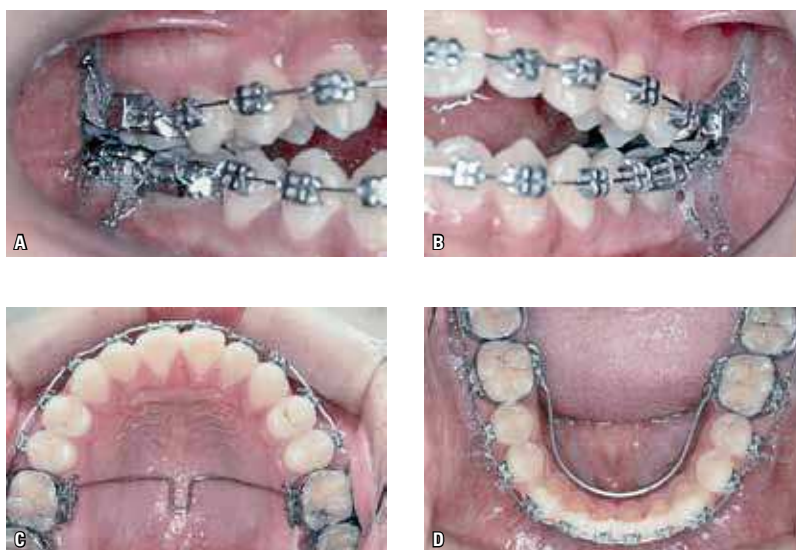


FIGURE 5 - . After leveling, microimplants were placed between all first and second molar roots for intrusion of the molar teeth. Transpalatal and lingual arches were inserted to prevent labial crown tipping.



FIGURE 6 - Post-treatment records of the skeletal open bite case.

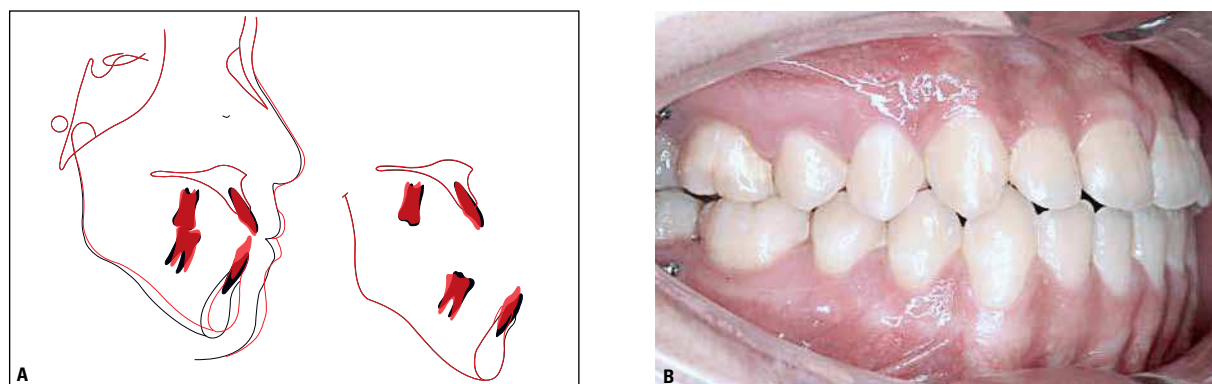


FIGURE 7 - Superimposition of pre- and post-treatment tracings of the openbite case(left) and 27 months of retention after treatment (right).

REFERENCES

1. KURODA, S.; SUGAWARA, Y.; DEGUCHI, T.; KYUNG, H. M.; TAKANO-YAMAMOTO, T. Clinical use of miniscrew implant as orthodontic anchorage: success rate and postoperative discomfort. **Am. J. Orthod. Dentofacial Orthop.**, St. Louis, v. 131, no. 1, p. 9-15, 2007.
2. KURODA, S.; YAMADA, K.; DEGUCHI, T.; HASHIMOTO, T.; KYUNG, M.; TAKANO-YAMAMOTO, T. Root proximity is major factor for screw failure in orthodontic anchorage. **Am. J. Orthod. Dentofacial Orthop.**, St. Louis, v. 131, no. 4, p. S68-S73, 2007. Supplement.
3. ROBERTS, E.; HELM, F. R.; MARSHALL, K. J.; GONGLOFF, R. K. Rigid endosseous implants for orthodontic and orthopedic anchorage. **Angle Orthod.**, Appleton, v. 59, no.4, p. 247-256, 1989.

Carlos Jorge Vogel

- Master of Science from the University of Illinois, Chicago, USA
 - Holds a Doctorate degree from the University of São Paulo
 - Member of the Edward H. Angle Society of Orthodontists
 - Former Managing Director of the Brazilian Board of Orthodontics and Facial Orthopedics.
-

Carlo Marassi

- Holds a Master's Degree from the Leopoldo Mandic Dental Research Center (CPOSLM);
 - Orthodontics Specialist graduated from the University of São Paulo (USP-Bauru);
 - Professor and Scientific Director of the Rio de Janeiro Straight-Wire Group;
 - Coordinator of the Orthodontics Specialist Course of the Leopoldo Mandic Dental Research Center (CPOSLM);
- Holds a Master's Degree in Orthodontics from the Leopoldo Mandic Dental Research Center (CPOSLM);
-

Fábio Bezerra

- Periodontics Postgraduate from the Bauru School of Dentistry, São Paulo University (FOB-USP);
 - Professor of the Implantology Specialist Course at the Bahia State Brazilian Dental Association (ABO).
-

Henrique Villela

- Orthodontics and Facial Orthopedics Specialist (ABO/BA).
 - Professor of the Orthodontics and Facial Orthopedics Specialist Course (ABO/BA).
 - Professor of the Orthodontics and Orthopedics Refresher and Enhancement Courses (ABO/BA).
 - Professor of the Orthodontics Refresher Program Course (Ortho postgrad / Bauru).
 - Guest Professor of the Orthodontics Specialist Course at "La Corporación Ortopedia y Ortondoncia del Chile", Santiago / Chile.
-

Jorge Faber

- Editor in Chief of the Dental Press Orthodontics and Facial Orthopedics Magazine.
 - Holds a Doctorate Degree in Biology from the Brasília University (Un B) Electronic Microscopy Laboratory.
 - Holds a Master's Degree from the Rio de Janeiro Federal University (UFRJ).
 - Professor of Evidence-Based Dentistry for the Brasília University (Un B) Sciences Postgraduate Program.
-

José Nelson Mucha

- Holds a Master's degree and a Doctorate degree from the Rio de Janeiro Federal University (UFRJ).
 - Full Professor of Orthodontics at the Rio de Janeiro Federal University (UFRJ).
 - Director of the Brazilian Board of Orthodontics and Facial Orthopedics.
-

Lincoln Issamu Nojima

- Holds a Master's degree and a Doctorate degree in Orthodontics from the Rio de Janeiro Federal University (UFRJ).
 - Adjunct Professor of the Postgraduate Orthodontics Program at the Rio de Janeiro Federal University (UFRJ).
-

Telma Martins de Araújo

- Holds a Master's degree and a Doctorate Degree in Orthodontics from the Rio de Janeiro Federal University (UFRJ).
 - Full Professor of the Bahia Federal University's School of Dentistry (FO UFBA).
 - Coordinator of the Orthodontics Specialist Course at the Bahia Federal University's School of Dentistry (FO UFBA);
 - Director of the Brazilian Board of Orthodontics and Facial Orthopedics.
-