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Resident Review

Editor's note: As private practitioners are regularly introduced to clinical information on new products, postgraduate orthodontic programs are in a great position to help guide them towards those products that have proven to be the most effective and efficient, and to verify the validity of manufacturers' claims. Thus, postgraduate orthodontic residency programs provide an ideal environment for testing evidence-based orthodontics. To encourage the further exposure of postgraduate research, we are introducing this new column, "PCSO Program Research Review," in this issue.

Program chairs will consider clinical and scientific research that has recently been published by their faculty or program and ask senior residents to write summaries of select articles published by their schools. Each program will publish a review once every three years. Based on alphabetical order, the first column has been written by a resident at A.T. Still University. I hope this new column will showcase the research being done at postgraduate orthodontic programs while serving as a valuable resource to practitioners as they consider introducing new products or techniques to their offices.

Established in 1892, A.T. Still University (ATSU) is recognized around the world as a multi-disciplinary source of health care education. Among ATSU's fine graduate programs is the Arizona School of Dentistry & Oral Health

(ASDOH). A leading institution since 2003, ASDOH maintains a unique focus on graduating community-minded health care providers.

The orthodontic program at ATSU is the only one that is fully accredited in Arizona. Since 2007, this young program has been at the forefront of many technological advances, including three-dimensional (3-D) imaging, digital orthodontics, and digital orthodontic models. Our faculty brings expertise in leading-edge digital orthodontic systems such as SureSmile, temporary skeletal anchorage devices (TSADs), lingual orthodontics, Invisalign, and soft-tissue laser therapies to the program.

Under the guidance of Dr. Jae Hyun Park, the program has made great strides in the realms of clinical orthodontics and research. Since 2008, Dr. Park has pioneered many research endeavors, publishing two books plus more than 130 articles in major peer-reviewed orthodontic and dental journals.

Cone-Beam Computed Tomography (CBCT)

CBCT is emerging as an advanced orthodontic imaging modality that is gaining great popularity due to its accuracy. The amount of diagnostic information to be gleaned from a CBCT image is immense, although deciphering that information may seem like a daunting task. In an attempt to provide a simplified means for analyzing CBCT

Figure 1. Cranial base superimposition using the iterative closest point (ICP) method (used with permission from The Angle Orthodontist)

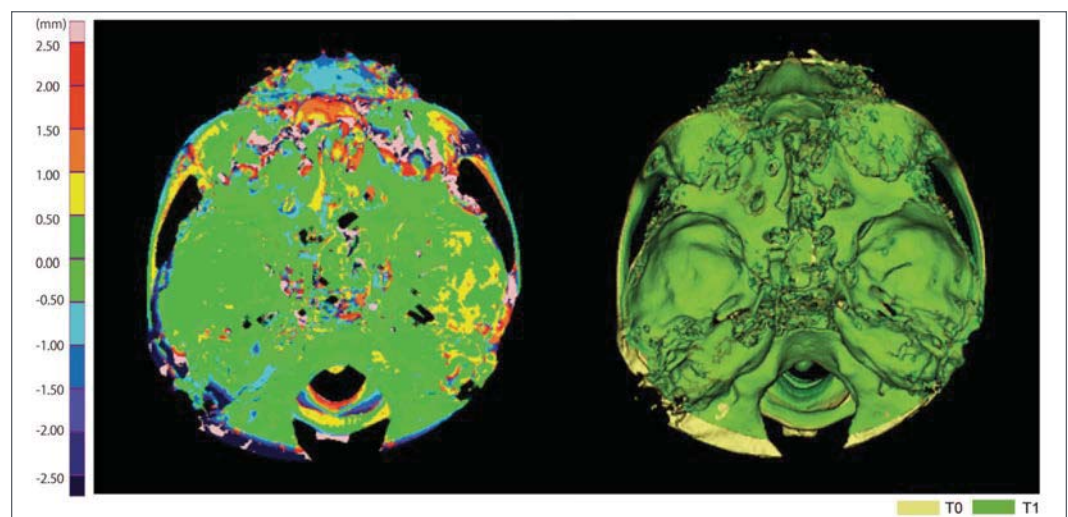




Figure 2. Drs. Jae Park (left) and Kiyoshi Tai won the Joseph E. Johnson Award at the 2011 AAO Annual Session Table Clinic competition for their CBCT superimposition techniques

images, Dr. Park became involved in studies related to superimpositions of 3-D CBCT images. With his colleague Dr. Tai, a visiting professor, he used one of the surface-based registration techniques to develop a superimposition protocol for evaluating dental and skeletal changes induced by growth/treatment (Figures 1 and 2).^{1,2}

Dr. Park's expertise in this field helped him spearhead a review of the various methods used to reconstruct 3-D CBCT images for diagnosis, treatment planning, and simulation. He reported thorough information about 3-D CBCT superimpositions related to these various methods, their clinical applications, benefits, and limitations.³ Such an in-depth review of CBCT superimposition techniques is bound to be of tremendous value to the newer generation of CBCT-savvy orthodontists.

Temporary Skeletal Anchorage Devices (TSADs)

Placement of TSADs has become routine for many orthodontic purposes, and our program is also at the forefront of this trend. These devices have facilitated tooth movement in directions and to levels that were previously considered

impossible, with minimal patient compliance. Because the palatal area is often used for TSAD placement, and because the success of TSADs is dependent primarily on the quality and quantity of bone and overlying soft tissue, Dr. Park and his colleagues have evaluated these variables to facilitate more predictable outcomes with TSAD usage within the program. They found that palatal bone was thinner in early mixed dentition, and bone thickness decreased laterally and posteriorly except in the anterior and midpalatal suture areas (Figure 3).⁴ Measurement of the soft tissue thicknesses showed that the thickness increased as the mixed dentition transitioned into permanent dentition. Palatal soft tissue thickness is different from the palatal bone thickness in that it increases laterally and posteriorly.⁵

Clinical Application of TSADs and CBCT

Our program is the only postgraduate orthodontic program in Arizona, so we are fortunate to be of service to patients with craniofacial deformities. They come to ASDOH's Center for Advanced Oral Health because it encompasses both orthodontics and an advanced general dentistry postgraduate program. As such, the orthodontic

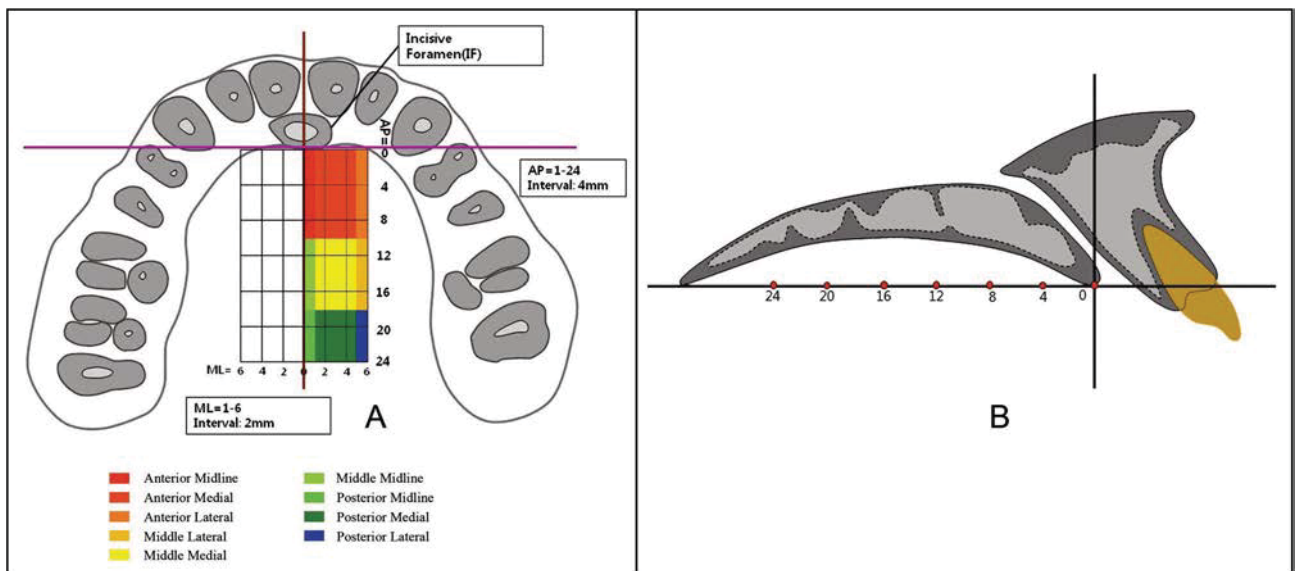


Figure 3. Reference line used to measure palatal bone thickness (used with permission from the American Journal of Orthodontics and Dentofacial Orthopedics)

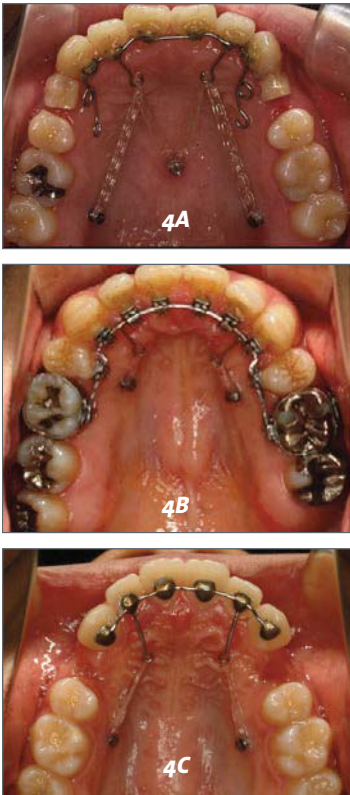


Figure 4. Modified lingual retractors and TSADs (used with permission from the American Journal of Orthodontics and Dentofacial Orthopedics and the Journal of Clinical Orthodontics)

program works in close association with the special needs unit at the university, and its affiliates. Information gathered from their studies on the evaluation of CBCT images allowed Dr. Park and colleagues to design appliances suitable for use in complex malocclusions with maximum effectiveness. They reported on the use of a double J retractor along with TSADs to close extraction spaces with retraction of the anterior segment (Figure 4A).⁶ They also demonstrated that esthetic lingual retractors, used in conjunction with TSADs, could be very helpful in treating bimaxillary dentoalveolar protrusion patients (Figures 4B and 4C).^{7,8}

In addition, they reported on the use of maxillary palatal appliances (MPAPs) that could be designed in novel configurations to correct various malocclusions in the sagittal as well as vertical planes, including total arch distalization and intrusion. They found that it was possible to use MPAPs for Class II treatment with distalization of the maxillary arch,^{9,10} and they were able to use the distalization capability of MPAPs along with extractions to achieve tremendous improvement

in the profiles of bimaxillary protrusive patients without surgery.¹¹ MPAPs are versatile and can be easily modified for use as molar protraction or distalization devices to correct Class II or III malocclusions¹² (Figure 5).

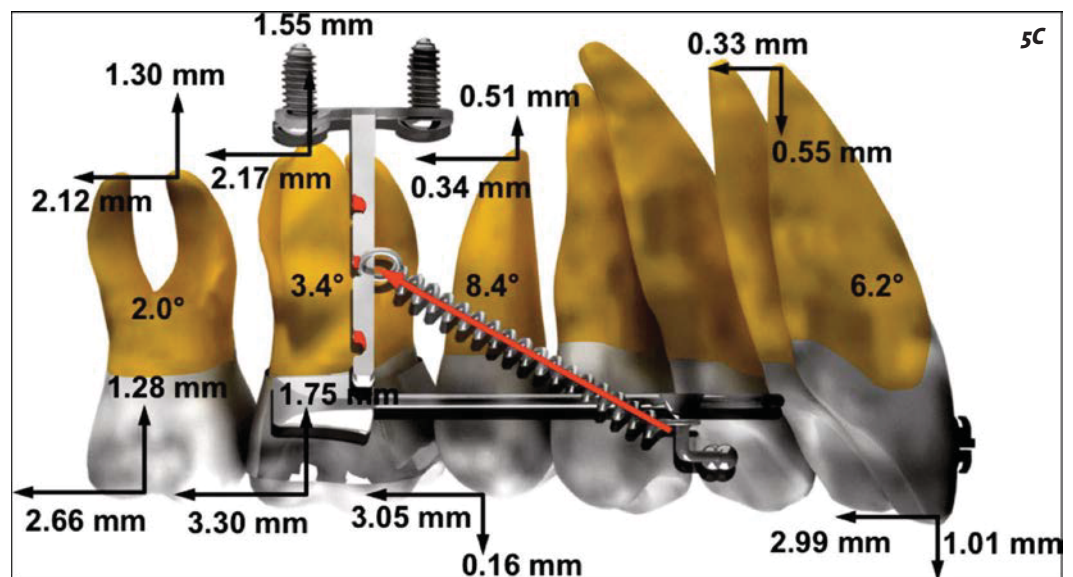
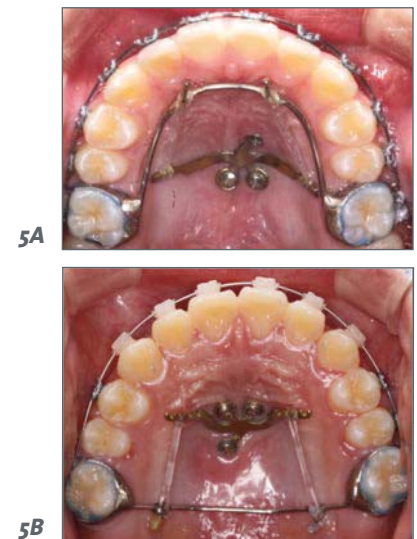


Figure 5. MPAP for (A) Distalization of maxillary dentition; (B) protraction of maxillary dentition; (C) mean maxillary dental changes after distalization using a MPAP appliance (used with permission from the American Journal of Orthodontics and Dentofacial Orthopedics)

Dr. Park and colleagues demonstrated the effective use of miniplate anchorage to treat an open bite with the help of TSADs, and they also elaborated on the differences between miniplates and miniscrews with respect to their applicability, anatomical considerations, advantages, and disadvantages. It all makes for a very informative and interesting read.¹³ Literature related to the use of TSADs to successfully treat difficult cases can be found in peer-reviewed orthodontic journals and in the book *Molar Protraction: Orthodontic Substitution of Missing Posterior Teeth* by Drs. Baik and Park.^{14–16}

The orthodontic residents have played a major role in pioneering and supporting the research conducted at the school, with guidance from Dr. Park. All residents are expected to perform original research and submit their research for publication in peer-reviewed journals prior to graduation. The department is currently involved in evaluating bone densities on CBCT images for orthodontic purposes, and in researching other interesting clinical and psychosocial facets of orthodontics and dentofacial orthopedics. ♦

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