by Dr. Joseph S. Petrey

One of the more challenging situations in orthodontic therapy can be in the treatment, retention and preparation for restoration of congenitally missing teeth in adolescent, growing patients. This difficulty is exacerbated when the missing teeth are in the anterior of the mouth and in the smile line. The prevalence of missing teeth is high in the orthodontic population as a whole, and of this high prevalence condition, maxillary lateral incisors are the third most frequently missing teeth.1

For years, common techniques for treatment of congenitally missing teeth have included fixed full coverage bridges, resin bonded bridges, tooth substitution and more recently the endosseous implant. There has been significant debate over the best treatment for these teeth, especially with consideration of the missing lateral incisor.2-4 To that end, it is fair to say that clinicians should be mindful of all treatment therapies and evaluate which best fits the specific patients needs. That being said, the viability of the endosseous implant as a successful restoration for congenitally missing teeth has revolutionized restorative treatments and patient care and in the proper case is the appropriate therapy for orthodontic patients with congenitally missing teeth. Many of our restorative colleagues have come to prefer implant therapy even with its challenges to full-coverage bridges which require tooth preparation, resin-bonded bridges that have a high rate of debonding, or tooth substitution which can have significant aesthetic considerations, especially in the case of maxillary canine substitution.

Patients with congenitally missing teeth can be successfully and aesthetically treated with endosseous implants. Unfortunately, these implants cannot responsibly be placed in all patients. If implants are placed and restored in growing patients, they become analogous to ankylosed teeth and they submerge relative to the adjacent teeth.2-4 In adolescent growth, the bone of the maxilla continues to develop vertically, and the dentition erupts with this vertical growth. Bone around implants, however, remains stationary during the adolescent growth period, leading to vertical bone defects and apparent submersion of the crown of the implanted tooth.

The problem for orthodontists is that most of our patients are 13-16 years old at the completion of treatment.5 Previous research has shown growth in the maxilla and mandible might continue at a significant level even beyond the second decade of life.5-6 In most patients then, it might be necessary to maintain orthodontic patients who are still growing for years prior to endosseous implant placement and restoration.

For years the traditional treatment for patients with congenitally missing teeth prior to restorable implant placement has been to fabricate pontic teeth on either acrylic Hawley retainers or within vacuformed retainers. These therapies are not without problems, however. Teeth on a retainer break from either Hawleys and vacu-
formed retainers, and more permanent sturdy retainers often are lost or broken in the extended retention phase.

The potential unease many adolescents have when removing their retainers and thus removing their “teeth” revealing a large edentulous space simply to eat also should not be dismissed. We ask our patients to maintain their post-orthodontic tooth position and wear their retainers, but we also ask them not to eat in these retainers. The nature of our retention protocol places our patients planned for restorable permanent implants in a very difficult position, asking them to expose their missing teeth while eating – a very social interaction. This is exacerbated as the ages of these patients are some of the most critical for social development. There is no wonder adolescent patients eat with their retainers in their mouths, and fracture fragile pontic teeth from their retainers. By maintaining our patients with teeth on retainers, we provide them with temporary gap fillers for missing teeth, but we place them in extraordinarily difficult situations in very social environments, of which many of them are self-conscious.

Recently, an innovative procedure to restore pontics with temporary anchorage devices (TADs) has been presented with the AAO Lecture of Dr. John Graham and his article in *Clinical Orthodontics.* This procedure of using TADs to support pontics is a revolutionary use of anchorage devices, and is beneficial not only for retention, but also in temporarily providing the patient with a pontic tooth during this phase of vertical facial growth. With this procedure, traditional temporary orthodontic implants may be inserted just as they are in routine orthodontic mini implant cases. Practitioners with any experience placing TADs can easily place mini implants in edentulous ridges to support pontics, and those without experience will find these TADs to be the easiest they will place, as there is no risk of root contact if properly placed.

Orthodontists who place TADs for interim pontics will add an additional monitoring of the TAD and its pontic to the retention phase, but this is not much added effort than for most patients planned for endosseous implants. For adolescent patients who are treatment planned for restorable implants, the retention phase is extended through the entirety of growth prior to implant placement. Orthodontists routinely maintain retention of these patients through this period, and maintain retainers with teeth and monitor retention with temporary resin bonded bridges. With the addition of the TAD-supported pontic, orthodontists will continue to have an active role in retention, through growth and prior to restoration, but with the added benefit of limited concern for relapse or space closure in the implant site due to broken or lost retainers.

*Immediate post-op facial photograph, left, of 16-year, four-month-old male following TAD placement and bonding of interim pontic for the congenitally missing maxillary left lateral incisor.*

*Immediate post-op maxillary occlusal photograph, middle, of 16-year, four-month-old male following TAD placement for the congenitally missing maxillary left lateral incisor.*

*Immediate Post-OP Maxillary Occlusal photograph, right, of 16-year, four-month-old male following TAD placement and bonding of interim pontic for the congenitally missing maxillary left lateral incisor.*
TADs used to support pontics in the retention phase in growing patients who are treatment planned for permanent restorative implants allow for: aesthetic temporary restoration prior to complete bone development and maturation, no need for Maryland Bridges bonded to teeth, or removable flipper retainers with pontic teeth on them that cannot be worn while eating and break easily. With pontics supported by temporary implants, patients also can maintain oral hygiene normally, brush, floss and are able to wear traditional retainers throughout the retention phase.

From clinical practice and with modifications to previous reports of this innovative procedure, the following steps and techniques are suggested:

**Preparation**

Prior to TAD placement, all active tooth movement in the location of the missing tooth should be completed. Preparation should be identical to the set-up for traditional endosseus permanent restorative implants as this will provide for adequate space for not only the interim restoration, but also the permanent implant and restoration. In most cases, implants should be placed following the completion of active treatment and after bracket removal, however if active movement is complete in the segment where the TAD-supported pontic is to be placed, this procedure may be undertaken while brackets are still bonded, though a supporting fixed lingual retainer is still recommended.

**TAD Placement**

TADs implanted to support temporary pontics should be placed on the center of the ridge palatal enough to ensure full bone contact and seated to the soft tissue collar. No less than a 10mm TAD should be used, and the implant collar should be completely seated to bone. TADs placed to the buccal run the risk of poor bone contact and if the implant head is too facial in the temporary restoration the TAD will show through the front of the restoration.

**Loading**

Following implant placement, clinicians should ensure that there is no mobility with the TAD. If primary stability is achieved, the implant may be immediately loaded with a temporary pontic. Clinicians may employ any means they are comfortable with in forming the pontic. My personal recommendation is to pre-form a custom pontic to a model of the patient’s edentulous ridge. I also recommend hollowing the pontic gingivally for placement on the TAD.

If using a preformed custom pontic, the pontic may be test-fit on a poured model and then adjusted. Even with hollowing of the pontic, the restoration may need to be adjusted to accommodate the TAD head. Once test fit is complete and the pontic crown is adjusted to seat to ideal position, fill the pontic with resin or acrylic material and place on the TAD. It might be necessary to add additional resin material to the palatal side of the restoration for stability, below the line of occlusion. Remove excess flash material and finish restoration in place.

Using this technique, no additional bonding material is needed. The interim pontics are held to the TAD with mechanical retention. For this reason, it is critical to choose an implant system that has significant undercuts for mechanical locking to the TAD head. Most well-designed TADs will have undercuts built into them for attachment of auxiliaries which may be utilized to mechanically retain pontics on TADs. As previously stated, implants should be seated to the soft tissue collar to ensure stability. For this reason it is important to utilize an implant with undercuts so it is not necessary to leave implants underseated to gain retention.

**Retention**

A bonded lingual retainer should be placed on the adjacent teeth and laid against
the temporary restoration to support it. Any type of fixed permanent retainer is acceptable, but the permanent retainer should adapt to the lingual surface of the pontic teeth but not be bonded to the pontic. It is important to remember, permanent implants are not being placed so as to allow teeth to erupt with vertical bone growth and development. For this reason, the fixed retainer should not be bonded to the pontic attached to temporary implants as this too will restrict the eruption of the adjacent teeth. For added support, the lingual surface may be troughed so the permanent retainer may adapt well to the pontic but again, it should not be bonded. In addition to the fixed retainer, a nighttime vacuformed retainer may also be worn for additional support and retention, though it is recommended to lightly block out the area of the pontic tooth.

**Additional Consideration**

Beyond the considerations concerning patient care, outlined above, there are additional considerations for the clinical orthodontist. The use of TADs to support pontics in growing patients is an excellent opportunity to communicate with referring general dentist, but potentially a detrimental one if handled improperly. The treatment of patients with congenitally missing teeth is one that requires interdisciplinary management. It is of utmost importance that the referring dentists and/or prosthodontists who will be restoring any future endosseus implants are not only made aware of the procedure, but are also on board and educated as to how the use of TADs improves retention and preparation for permanent restorations. It is imperative to reassure referring dentists this procedure is a retention, not restorative procedure. Orthodontists traditionally manage retention until restorable implants are placed, so it is only natural that we manage our pontic patients during this growth period. It also might be beneficial to treatment plan with conscientious general dentists and offer the service of serial cephalometric radiographs to determine growth cessation during this maintenance and monitoring period. The key point to make with referring dentists is that this is analogous to a retainer with a tooth on it, simply holding space and bone until they are ready to place a permanent implant.

It also might be a service to both orthodontists and referring dentists to give referring dentists the option of restoring the pontics, though other authors have suggested otherwise. In most cases restorative dentists will prefer orthodontists to restore the pontics on TADs and take on the responsibility of their maintenance, but by giving referrers the option, the orthodontist assures that the referring dentists do not feel a restorative procedure is taken away from them. Orthodontists have the most training, the most experience and the greatest comfort with TADs. It is only natural that the orthodontist is the appropriate person to maintain the TAD and temporary restoration just as would occur in retention maintenance. In most cases, the orthodontist who placed the TAD and will be maintaining the patient’s retention has the best understanding of the procedure and best restoration to have a fixed retainer supporting the pontic, but the offer for the referring dentist to restore can go a long way to maintain referring dentists’ confidence.

It is also important to reassure referring dentists this procedure will not negatively affect future endosseous implants. In nearly all restorable implant systems, TAD widths are at a minimum 1/2 to 1/3 the width of the endosseus restorable implant. If properly placed then, the insertion site for the TAD will be well within the pilot hole for the restorable permanent implant, and the restorable implant may be immediately placed upon removal of the TAD. As the narrowest restorable implants are generally 3.5mm wide or larger, well placed TADs maintained without the presence of infection should have no appreciable effect on permanent restorable implants.
There have also been suggestions that TAD placement in edentulous spaces maintains vertical bone height. While there is significant biological plausibility and compelling evidence from bone retention with osseointegrated implants, the lack of studies demonstrating this benefit with temporary anchorage devices should lead the clinical orthodontist to be cautious in treatment planning this therapy expecting bone preservation. In fact, national lecturers have warned against this procedure, as their belief is that placement of an implant in a growing ridge might halt future bone loss, but may impede continued vertical bone growth much like osseointegrated implants. This interpretation of the problem however is mired in the understanding that the edentulous ridge will develop naturally as adjacent bone grows. As these ridges are resorbing ridges, the question arises as to whether the risk of affecting vertical growth is outweighed by the benefit of the cessation of vertical bone loss. It is also important to consider that the majority of patients with congenitally missing anterior teeth will require vertical and buccal bone grafts in addition to endosseous implant placement, and the benefits of TAD-supported pontics might outweigh growth affecting concerns as in many patients bone grafts may be inevitable. This controversy will continue however until well designed research studies evaluate the detrimental or beneficial effect on edentulous ridges with TAD placement and practitioners should be conscientious of the lack of solid clinical evidence on this question of TAD placement in growing patients.

Conclusions

In the end, the placement of TADs for the support of pontics in edentulous spaces in growing patients clearly offers unique and exciting benefits for orthodontists, restorative dentists, and certainly our patients. From better retention to assisting our patients with more socially beneficial temporary teeth, TADs provide the clinical orthodontist a unique therapy that answers many of the confounding aspects of treating patients with congenitally missing teeth. Taking into consideration the techniques and additional considerations presented here, this relatively simple procedure should be considered in growing patients prior to restorable implant placement.

References


Maxillary occlusal photograph of Dentaurum TOMAS implants placed in the edentulous space of the maxillary lateral incisors prior to pontic placement.

10mm self-drilling Dentaurum TOMAS implants in process of insertion in the edentulous space of the maxillary right lateral incisors.

Test fit of temporary bisacrylic pontic on a 10mm self-drilling Dentaurum TOMAS implant.

Maxillary occlusal photograph of Dentaurum TOMAS implants placed in the edentulous space of the maxillary lateral incisors prior to pontic placement.

Author’s Bio

Dr. Joseph S. Petrey owns and operates Petrey Orthodontics in Somerset, Kentucky, and maintains active practices in Corbin and Hazard, Kentucky. He holds a Master’s Degree in Public Health and completed his dental and orthodontic training including his Master of Science and Certificate from the University of Kentucky. Dr. Petrey delivers national lectures on temporary anchorage devices including topics on techniques for success and insertion and instructional lectures on innovative TAD usage. He also teaches continuing education courses on TADs, lingual orthodontics, and the treatment of impacted canines. Dr. Petrey also has published numerous articles including his AAO Harry Sicher Award nominated article on TAD insertion variables effects on retention and has contributed to multiple technique and clinical reference guides.