

# Excerpts from the discussion between the Active Members of the EAED and the Speakers

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## Interdisciplinary treatments with restorative needs

*Aris Tripodakis:* Could you summarize the sequence regarding how you analyze the facial architecture and then how you proceed with tooth positioning in relation to the face?

*Greggory Kinzer:* I use the same rules that apply to the edentulous patient. My goal with the positioning of the anterior teeth is that I want the patient to show some display at rest, but the amount of incisor display varies with age and lip mobility. For instance, the more mobile the lip, the less I have to show at rest because the mobility of the lip in normal dynamics will show most of the central. The less mobile the lip, the more I tend to show at rest. Another way of evaluating the teeth relative to the lips is to use cephalometric analysis. I personally use photos because cephalometrics does not give the dynamics. Many people today use videos with their patients. Research shows that there may be a 40% change of lip mobility with a posed smile as opposed to a spontaneous smile. So, I agree that dynamic lip movement is very important.

*David De Franco:* In patients with a Class III skeletal relation, do you always

consider orthognathic surgery to correct the skeletal problem?

*Greggory Kinzer:* We need to look at the face. If a patient tends towards a dental Class III, but facially does not look like a Class III, we do not recommend orthognathic surgery.

*Federico Ferraris:* How do you coordinate the decision-making process within the team?

*Greggory Kinzer:* It typically starts with the restorative dentist. I discuss what I'm thinking with the patient in general terms, and, then, I refer him/her to the other specialists. They see the patient, who does not yet receive a plan since we need to discuss the case first. After that, it is the restorative dentist who has the responsibility of laying out what is going to happen, including a timeline. The restorative dentist will then communicate this to the patient, along with the financial costs.

*Stefano Gracis:* In my experience, communication among the members is crucial in a multidisciplinary treatment. Only if everybody is clear about what has to be done, can a successful outcome occur. My questions are: How often do you do an orthodontic setup and a diagnostic



wax-up? Who is responsible for overseeing this? Do you do it, or does your technician do it? And what is the role of the dental technician in the team?

*Vince Kokich Jr:* There are two different kinds of patients. There are those who only require orthodontic treatment without major restorative needs. In these cases, the setup is not mandatory, but I may still elect to do it to establish the direction of treatment. After completing it, I can meet with the restorative dentist to agree on the treatment. In the more complex restorative cases, I have the models duplicated and tell the technician what I want to see. Then, the setup comes back to me and I evaluate if it is realistic from a mechanical standpoint. If I see that what the technician has done is not what I meant, I will move the teeth myself into the position that I know can be achieved. At that point, I will show it to the prosthodontist, who may request some additional tooth movement after the restorative wax-up has been carried out. Unfortunately, the reality is that most orthodontists don't use setups since they are an added expense. But you cannot treat adult patients without setups.

*Stefano Gracis:* In those cases where you need implants for anchorage to move teeth, what protocol do you follow?

*Vince Kokich Jr:* I don't often use definitive implants as anchorage. I prefer to use temporary anchorage devices (TADs), when possible. I don't want to have the final implants already in place at an early stage since they may interfere with the ideal tooth position.

## Horizontal and vertical tooth movement

*Federico Ferraris:* When a canine is moved into a lateral incisor position where there is a large defect, can we expect to see bone formation on the mesial side?

*Vince Kokich Jr:* There have been studies carried out to evaluate ridge stability after tooth movement. Novackova from the Czech Republic conducted a study where maxillary canines were allowed to drift into missing lateral sites and were then moved distally. Over time, the ridge was found to be very stable (less than 2% decrease in ridge width over 5 years). More recently, Eliasova conducted a study looking at the development of the mandibular premolar area through orthodontic tooth movement. This proved to be slightly less stable (4.2% loss over 5 years). Unfortunately, we don't know exactly how wide a ridge should be when we move a tooth into it. For example, if there is a congenitally missing mandibular second premolar and you extract the primary second molar, that ridge will resorb (76% on the facial, and about 24% on the lingual). This will result in a narrow ridge. As you move the first premolar distally, you don't cause a dehiscence. This means that you can grow bone over this area. However, we don't know a specific minimum ridge width compared to the width of the root of the tooth we are moving.

*Jim Janakievski:* If you do an extraction and you want to move a tooth into that site, our experience with grafting of the ridge has not been very good when a

xenograft is used. In such a case, the tooth will move very slowly since it takes a long time to remodel that bone. For this indication, we prefer to use only allograft bone.

*Siggi Marquardt:* If you move a premolar mesially, how fast can the movement be, and for how long do you have to retain it? What about extrusion? How much can we expect if we extrude teeth slowly?

*Vince Kokich Jr:* Typically, if I'm moving a tooth into an edentulous site, I generally expect to see a little less than 1 mm per month. So, if I have 7.5 mm of space, it will take me 8 to 9 months to get that tooth into the desired position. The hardest part is to upright the root in order to have enough space in between the roots to place an implant. All those patients will have a wire bonded on the labial surface from premolar to first molar for at least 1 year.

*Jim Janakievski:* When comparing distraction as opposed to orthodontic extrusion for vertical development of bone, another option to consider is orthodontic distraction. Orthodontic extrusion is dependent on the healthy periodontal attachment to the bone. How far the attachment wraps around the line angle is a limiting factor. In some cases, orthodontic extrusion is a useful technique to help with or minimize grafting. Alternatively, orthodontists can use wires and brackets as distraction devices. The surgeon will raise a flap, make the vertical and the apical cuts to free the segment of bone, and then replace the flap. The orthodontist can then erupt not the

teeth but the segment of bone. The teeth will still need to be reduced as they are moved coronally.

*Stefano Gracis:* Could you tell us which limitations apply to horizontal movements of a tooth?

*Greggory Kinzer:* Moving the tooth across the midline. I don't know what is the predictability when you cross the midline suture.

*David De Franco:* I don't have a lot of experience moving central incisors across the midline. However, I don't see any reason why biologically you would not be able to move a tooth across the midline. The suture just becomes remodeled like the gingiva.

*Vince Kokich Jr:* I think the limitations are fewer today, thanks to the anchorage options that are available. Jim and I had a limitation on one of our patients where we took out two centrals and moved the laterals into the grafted central sites. It was very difficult to move the teeth and upright the roots. In this instance, we concluded that the material we used for grafting caused the difficulty.

*Jim Janakievski:* In this clinical case, the xenograft was pushed out to the facial, almost like an exostosis, and I had to do crown lengthening and osteoplasty to give it a normal scallop. The same thing would apply to a ridge if it is only cortical bone and you're moving the tooth through a much denser bone. It takes longer and there is a risk of dehiscence.



*Kony Meyenberg:* Do you have any experience creating a ridge by orthodontically moving a tooth back and forth?

*Vince Kokich Jr.:* In our experience, moving the canine distally improves the bone but you frequently still have to graft. If it doesn't eliminate the grafting procedure it may not be worth doing, since bone grafting by itself can be very successful.

*Jim Janakievski:* It takes so much effort to move the tooth orthodontically and move it back. You gain width by moving the teeth in a horizontal direction, not vertical height. Today, horizontal grafting is much more predictable. I no longer refer patients for orthodontic treatment to have teeth moved to get buccal bone. Orthodontic extrusion to get proximal bone is more important since it is challenging to graft. But, for the buccal bone, it is very predictable to graft the ridge.

*Deborah Vilaboa:* In the case of vertical growing patients with long faces and unstable occlusion in the anterior, who have a natural tooth between two implants, would a night guard prevent vertical drift of the tooth?

*Vince Kokich Jr.:* I don't know what the benefit of a maxillary night guard in this case would be. If it's a flat plane night guard where all the teeth contact, you may get problems. These vertical growing patients are backward rotators. As the bite opens, with a maxillary night guard, you end up getting extrusion of the mandibular anterior teeth. It is not an issue for mandibular implants, but getting patients to wear the night guard

for a long time is difficult. I have been wearing one for 25 years and I am very used to it, but there are patients who just cannot wear them.

Theoretically, if you have a night guard that goes over all the teeth in the mandibular jaw, it could keep the spaces closed, and it could prevent the vertical eruption of the teeth. However, that's not the typical retainer I use in adolescent patients. My traditional retainers are wraparound Hawley retainers. With this kind of retainer, I manage to prevent the mesial drift a lot better.

## Age limitations for implant placement

*John Orloff:* Can you please give us information on the age limitation for placing dental implants, especially the minimum age? Is there discussion going on about switching from dental implants to transplantation in young patients?

*Vince Kokich Jr.:* We see eruptive changes that happen as we get older (in our 40s and 50s), and we call them growth changes. I am not totally convinced yet that they are true growth changes. However, we see infra positioning of the implants and teeth in those patients who, theoretically, finished growing a long time ago. If we are able to do more transplants, we will end up with a periodontal ligament, the tooth will have proprioceptive innervation and an eruptive potential, which is the ideal situation. But we cannot do that for every patient. I may not see the young patients at the right time to get them referred to Jim within the window of time in which we

can transplant teeth. The reality is that we will still need to do dental implants. We have to choose the right patients on which to do this, based on the reviewed literature. The ones that I would be most concerned about are adult females with long faces. It really has to do with their growth direction. If you are a vertical grower and more of a backward rotator, you potentially are at risk of developing a skeletal open bite. And if you don't have a contact in the anterior, the teeth will continue to erupt. We know that teeth also erupt in adults. If there is no contact and you have this open bite developing, you are going to see changes relative to the implant positions. Although I have worries, I don't have all the answers. However, I would say that our philosophy is definitely changing.

*Greggory Kinzer:* I think it's a really interesting question. Note that transplants are all centrals – if a lateral or a cuspid is missing, transplant is not an option. The transplant option has a small window of opportunity. If the age range or the development of the premolar is beyond acceptable, then we lose the opportunity. The difficulty with managing these young patients is that the more dentistry you do on a young patient, the more potential there is for future problems. So, if we can be conservative and take advantage of adhesion by bonding restorations, we are able to make changes that are not detrimental to the tooth. Implant placement does not offer us this ability. Implant placement is a marker in time. There are adult patients who will have eruptive changes, most likely due to unstable anterior relations. There is a higher potential for this with

younger patients since they lack stability because their teeth are continuously erupting. The longer we can wait to place implants in young patients, the better. But you have to manage the ridge and the interim tooth replacement. There are many challenges when trying to delay implant placement.

*Vince Kokich Jr:* I want to add one thing about interim tooth replacement. That is something orthodontists often struggle with when treating adolescent males who complete orthodontic treatment at the age of 14 to 15. We are discussing the possibility of waiting potentially even longer before we place an implant. In the US, there are people trying to place TADs (mini screws) and restore them with temporary crowns to manage that area. It doesn't make any sense because, when you screw down the periostium, you are screwing down the periostium. The teeth are going to erupt, and when you hold back the bone growth due to this temporary implant, you are still going to see the vertical problem.

The other issue is that there are many general dentists in the US placing implants. Most don't have the training or the treatment-planning knowledge. However, most of them are going to place those implants because the patient wants them and they are willing pay for the procedure. I think we are going to see problems in these types of patients.

*John Orloff:* I understand that it is very difficult to provide us with a specific minimum age. If it is not a numeric age, can you at least tell us when we are not supposed to place implants in growing children?



*Vince Kokich Jr:* I don't want to place implants in a growing patient.

*Stefano Gracis:* Whom do you consider to be a growing patient? How do you assess this?

*Vince Kokich Jr:* Typically, what I do to assess the end of growth in a patient is to take serial head films when I think growing has slowed down or is pretty close to being complete (for a male, around the age of 18). I will take the first head film as a starting point, then have the patient back in a year to take another film. I will then superimpose the two films and, if I don't see any changes, I may conclude that the patient has reached skeletal maturity. This doesn't mean that I will proceed immediately with placing an implant. I may wait longer because I can manage these sites pretty well with the fixed retention I usually use, which is basically a resin-bonded bridge that maintains the position of the adjacent teeth, the central and the canine, so that they don't relapse. With this solution, waiting another 4 to 5 years is very reasonable. But, to answer your question, we determine the end of growth using serial head films.

*Tidu Mankoo:* We see growth even in adult patients. I have patients in their 50s or 60s where we see it happening, especially the submerging implant. So, it is not only in young patients. However, especially for young patients, we cannot emphasize enough the usefulness of the resin-bonded bridge. We have a lot of good data regarding zirconia Maryland Bridges. I've been using them. Why not place a zirconia Maryland Bridge as a long-term or medium-term definitive

restoration? You can buy 10 to 15 years this way. I would rather place an implant when a patient is 35 than when the patient is 25 or 19. Esthetics is perfect, you manage the space, you keep the space, and there is really no downside.

*Greggory Kinzer:* My concern is the interior surface of zirconia, since it cannot be etched. I don't know what needs to be done to the intaglio surface to obtain a reliable adhesive bond.

*Tidu Mankoo:* Sasse and Kern published their protocol in QI in 2014. There is 10 years of data that demonstrates that it works. Lithium disilicate breaks, which is why I do it with zirconia. I sandblast the zirconia wing and then I use a phosphate monomer to adhesively bond it.

## Tooth transplantation

*Michele Bovera:* If you decide to transplant a premolar from the mandibular jaw to the anterior area and you have a failure, how do you justify this to the parents, and legally?

*Jim Janakievski:* This is the reason autotransplantation is not very popular in the US. It is believed that there is a high risk with this procedure and, therefore, a high risk of a potential lawsuit. A good discussion with the parents reviewing the possible risks is important.

*Michele Bovera:* How do you discuss this matter with the parents?

*Jim Janakievski:* The initial discussion usually begins with the referring

dentist or orthodontist, who will discuss the options for an ankylosed or missing tooth, including considering using a natural tooth transplantation to this anterior site. The benefits presented will include maintenance of the alveolar ridge throughout the child's growth and development, and having a natural tooth during these formative years. I tell the parents that 1 out of 10 transplanted teeth will develop a problem. The problems are either ankylosis or pulpal necrosis. Pulpal necrosis is treatable, but ankylosis is not.

*Michele Bovera:* How many years of follow-up do you have in your practice with this technique?

*Jim Janakievski:* Eight years.

*Tidu Mankoo:* Is there any way that you can transplant a tooth in an adult patient? Can you cut the root and try to stimulate the bone growth?

*Vince Kokich Jr:* First you have to do the orthodontic treatment and set the occlusion, then you can transplant the tooth.

*Jim Janakievski:* Adult teeth will need endodontic treatment. One option would be to plan to have the endodontic treatment of the transplant tooth completed prior to the transplantation procedure. The other option is to plan for the endodontic treatment very soon after the transplantation procedure. However, in adults, you will have to transplant the tooth in the exact position where you want it to be restored because there is a high risk of ankylosis.

*Greggory Kinzer:* You actually end up treating a "natural tooth implant", and you end up with two sites to manage: the site from where you harvested the tooth and the transplanted site. Why don't you make it simple and do an implant in those cases?

*Giano Ricci:* Do you need primary stability of the transplanted tooth?

*Jim Janakievski:* No, you don't. If you've prepared a good osteotomy, and you can position the tooth to achieve limited mobility, then you can just suture it. If the osteotomy is bigger, or if it was necessary to fracture the bone in order to expand it, then there is a high risk of mobility of the tooth and, therefore, a rigid splint is needed. The retention period is longer in such a case (6 to 7 weeks), when compared to the retention period for a traumatized tooth, where you typically use a non-rigid splint for a short period of time. Remember that there is no intimate fit within the socket and therefore the healing will take longer.

*David De Franco:* Today, many premolars are still being extracted in young patients as part of orthodontic treatment. Could adult trauma patients benefit from the transplanting of a premolar from a child?

*Jim Janakievski:* Research has been undertaken to investigate tooth transplantation between siblings, family members, and unrelated donors. Unfortunately, it has not worked. There is always ankylosis as well as poor pulpal outcomes. I think transplanting from a child to a parent is good logical



thinking, but you would have to accept the ankylosis and eventual root resorption.

## Restorative considerations

*Massimo Fuzzi:* When I treat a complex case, I am concerned about the incisal edge and the position of the central incisors. Yet, we also need to be concerned about the functional aspect. When you plan a case, how do you set the inclination of the anterior guidance, and how do you evaluate phonetics? Does a reduced periodontium alter your approach?

*Greggory Kinzer:* My philosophy would be to place maxillary anteriors in an esthetically derived position, but we must also check phonetics. The functional component doesn't come into play until I start placing mandibular anteriors. The palatal surface of the maxillary teeth and the incisal edge position of the mandibular teeth will determine the function, the vertical dimension, the maximum intercuspation, and the disclusive pathways. However, in severely worn dentitions, I would try to determine the cause of wear. The idea that, by changing the occlusion, you can alter the behavior is unfounded. If you can find out what caused the wear and build a safety factor into your restorative design to prevent further problems, you will be ahead regarding predictability. So, it is important to determine the amount of overbite, the angle of overjet, and the number of teeth discluding. However, we don't want to detract from esthetics in order to obtain function. The good news is that we are

able to place the mandibular teeth in many different positions that work esthetically, thus designing different types of occlusion. The outcome on many patients may look vastly different to what we consider "ideal" occlusion, because that is, in fact, what they require, since their particular functional needs are different from the needs of others.

*Massimo Fuzzi:* How can you measure the occlusal coordinates that you are changing?

*Greggory Kinzer:* There are two schools of thought. The first is that you design occlusion on a splint and test it on a splint. My issue with this is that it is tested on the splint and not on the teeth. For me, trial therapy at the tooth level is the most important step. Maybe we need to place provisionals, maybe bonding with resin, maybe a combination of the two. But it must be tried in the environment. When I do my trial therapy, it may be in place for 3 to 4 months, during which time I do not want my patients to wear an appliance because it can mask a potential problem. If my design is not correct, my patient will experience breakage, mobility, TMD symptoms, and decementation, in which case I would change the design before I moved on to the definitive restorations. In this way, I try to decrease the number of catastrophic failures. Unfortunately, they still do occur, but we want to decrease their number.

*Beatrice Vilaboa:* Do you still consider cuspid guidance to be a major factor for the long-term stability of our treatments?

*Greggory Kinzer:* If you go back to the history of how we chose cuspid guidance, you will see that it came from the evaluation of unworn teeth. If you look at the percentages of patients who have cuspid guidance, you find that younger patients, around 18 years of age, have it in 50% to 60% of cases. But when you get up into the 50s age group, it drops to 5% bilaterally and 2.5% unilaterally. So, do I think it is crucial? No. Why do we design it? Because it is easy. When do we change it into more of a group function? When we find out in the diagnostic phase that the guidance on two teeth does not work. Then, we have to spread the force over multiple areas in order to have a wider distribution. But when the possibility of proprioceptive feedback does not exist, splint the teeth. With multiple periodontally involved teeth and implants, we have to spread forces over larger areas. So, we would modify it into an anterior or slightly posterior group function.

*John Orloff:* In the British Dental Journal there was an article about what they called anthropological occlusion, which actually showed that, after a period of time, about 40% of all the patients moved from canine guidance into balanced occlusion, some of them even achieving fully balanced occlusion on both sides.

*Greggory Kinzer:* The more teeth you pick up, the more muscle activity you tend to develop. There is evidence to show that canine guidance shuts down the muscle activity; and it does, but not in all patients. In patients who have a parafunctional activity, I prefer to spread the

forces to more teeth. Two teeth touching does not mean shutting muscles down; it means that two teeth have to withstand higher forces.

*Jaime Gil:* Do you use your provisionals to establish the angle of disclusion?

*Greggory Kinzer:* Yes. Let's consider designing an occlusion for a patient with attrition. Many things cause tooth wear. What concerns us are the things that are attrition-oriented, that is, tooth-to-tooth contact. Shallow guidance is always going to be more predictable. So, less overbite, more overjet. Look at the Weinberg study on implant guidance. For every 10 degree plus or minus of disclusive angle, the change of stress of the fixture level was 32%.

*Guido Bracchetti:* Can you tell us what your current prosthetic solutions are for implant prosthesis, and what kind of abutments and materials you use when you finalize your cases?

*Greggory Kinzer:* Our designs continuously evolve as materials change. From my point of view, I'd like to have a metal sleeve coupling with the implant and the abutment. Zirconia as an abutment is fine, but having the zirconia hex fitted in the implant means a potential risk of fracture. The smaller the implant, the higher the risk. The cases that I've seen fail are the ones involving smaller diameter implants. So, using customized metal-ceramic abutments makes sense. In my hands, almost everything is customized because I want to control the contours and, if it is cementable, I want to determine the location of my cement



margin. There are all sorts of materials we can use. We want esthetic materials in case we have tissue that moves. If I can, I custom stain the abutments, infuse the zirconia with color or use customized metal-ceramic abutments. We can also bake different ceramics or add fluorescence and coloration to make them look like root structure. To summarize, customized abutments are paramount. As far as materials are concerned, I've been avoiding monolithic zirconia abutments for implants with internal connections, but I am fine with zirconia as a material, even though lately we've been using lithium disilicate cemented over metal. I'm evolving more towards screw-retained restorations for retrievability in case there is a problem years down the line. With screws, we have better fit, better tolerance, and good stability, since screws have been improved as far as torquing ability is concerned.

*Aris Tripodakis:* When you talk about metal-ceramic abutments, are you referring to gold alloys with a prefabricated internal hex?

*Greggory Kinzer:* Yes. To make a custom abutment, we add wax to a prefabricated base and then cast a noble alloy to it.

*Aris Tripodakis:* There is research that supports the biologic benefits of having all-ceramic abutments as opposed to gold-ceramic abutments, ie, the Abrahamsson study in dogs. Yet, we also have Paolo Vigolo's randomized controlled trial (RCT) that confirms the very good response to metal-ceramic abutments. Do you see any biologic differences between the two?

*Greggory Kinzer:* We do not do histological studies on our patients, so all I can give you is a visual response regarding the health of the soft tissue. Regardless of the material chosen, I see good tissue health, as long as the material is properly polished. I don't know whether there may be a histologic difference, but clinically I don't see it.

*Stefan Paul:* I'd like your opinion on abutments that follow the natural shape of the cemento-enamel junction (CEJ), as opposed to the cylindrical healing abutments that you've shown in many cases.

*Greggory Kinzer:* We try to create the soft tissue profile in one of many ways. It might be done in an immediate approach at the time of surgery via immediate provisionalization or customized healing abutments. Alternatively, the healing abutments you've seen are the very small diameter abutments used in order to obtain more soft tissue volume. The soft tissue still needs to be shaped, but it's going to be shaped prosthetically. It's the provisional that remodels the soft tissue contours. If we have a proper soft tissue volume, our goal will be to maintain the soft tissue profile by using something that has been customized to create an emergence profile that imitates the natural tooth.

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