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We Must Not Waiver

Dentistry faces a formidable foe in those who would ban fluoride from our drinking water.
For the health of the children, we must continue our public education efforts.

On May 5, the Oneida City Common Council voted 5 to 1 to keep fluoride out of the city water supply. This was a victory for anti-fluoridationists, who campaigned vigorously to keep the water fluoride-free. Looking at the vote, I think it was a financial decision on the part of the Common Council rather than a vote against fluoride. To institute a fluoridation project, Oneida would have had to spend $40,000 for the necessary equipment and an additional $30,000 for the fluoride itself. At a time when municipal budgets are tight, it makes sense that the Oneida Common Council would not want to spend money on a controversial project when more favorable projects are in need of funding.

I say this because on that same day, in Rockport, MA, citizens voted 1,186 to 800 in favor of continuing fluoridation of that community’s water supply. I assume the same pro- and anti-fluoridation arguments were made in the days leading up to the vote. However, one difference in the two processes was only six people voted in Oneida and over 1,900 voted in Rockport. It’s possible that the six people voting in Oneida were more influenced by fiscal concerns than were the voters in Massachusetts, because that was their job. It’s also possible that the nearly 2,000 people who voted in Rockport were more concerned about their health and what could be done to help make it as optimal as possible. Additionally, Rockport has a history of fluoridation and experience with its possible side effects. And the residents there have first-hand knowledge of the arguments made against adding fluoride to the water supply and have concluded it’s so much bluster.

Anti-fluoridationists will use any tactic to keep fluoride from being added to community water supplies. A study out of Harvard in 2012 entitled “Developmental Fluoride Neurotoxicity: A Systematic Review and Meta-analysis” by Choi et al., published in Environmental Health Perspectives, questioned whether fluoride affected neurological development. The researchers concluded that there was a significant difference in the IQ’s of children exposed to high levels of fluoride in drinking water. Anti-fluoridationists have seized on this study to support their contention that fluoride causes adverse effects in developing children. What they fail to mention, but what is included in the Harvard study, is that the levels of fluoride these children were exposed to were much greater than what is recommended when fluoride is added to community water supplies. Also, the children cited in the study were exposed to environmental fluoride from coal burning, adding to their overall intake.

There’s one other thing about the studies cited in the Environmental Health Perspectives article.
They were all from China, with the exception of one from Iran. China does not fluoridate its community water supplies, and hasn’t since 2002. And, in areas where water contains naturally occurring fluoride, the concentrations are close to what is recommended in the United States. In these areas, there was no difference in the IQ of children exposed to fluoride and those who were not exposed.

Finally, the China studies had no controls. They were simply epidemiological studies of populations exposed environmentally to fluoride with no control over the concentration of that exposure. By contrast, all studies done with strictly controlled populations have shown a significant decrease in the caries rates among children exposed to the optimal concentration of fluoride with no adverse health effects. Of course, anti-fluoridationists never cite these studies, and they have a habit of misrepresenting studies that purport to support their position, but with careful reading actually don’t.

Anti-fluoridationists also point to Europe, where water supplies are fluoride-free with no adverse effect on caries rates. However, there is one big difference between Europe and the United States. In Europe, unlike in this country, school-based dental care is made available to children. In fact, a great many children in this country do not see a dentist regularly, which contributes to the high pediatric caries rate seen here. In many cases, a fluoridated water supply is the only defense these children have against tooth decay.

We all know, or should know, that fluoridated water significantly reduces the incidence of caries in children and in adults. Studies have shown that reduction to be as high as 60% in children and around 30% in adults. The Centers for Disease Control has cited community water fluoridation as one of the top medical achievements of the 20th century and has ranked it higher than the health effects of smoking. The ADA has made fluoridation a key component of its Action for Dental Health, a nationwide effort to improve access to care for people suffering from untreated dental disease, to strengthen public and private safety nets, and to educate and prevent oral health disease in communities across the country.

Recently, the Department of Health and Human Services lowered the recommended ratio of fluoride to water to 0.7 parts per million. This recommendation is based on sound scientific research. Unfortunately, for the anti-fluoridationists, no amount of fluoride in the water supply will ever be acceptable. They are a strong, vocal minority in this debate. They often rely upon junk science, and they misinterpret sound research. They will leave no stone unturned in their fight against this proven health initiative. It is our responsibility to educate the public on the safety and efficacy of water fluoridation. We must never waiver in our support of this important tool for eradicating childhood caries.

About that Cover
On another note, the cover for the March issue of The NYSDJ garnered a great deal of comment, much of it negative. If you remember, this cover shows a clinician working on a patient wearing a facemask with his nose exposed. Please know we are all cognizant of the proper infection control protocols we must follow in the practice of dentistry. Unfortunately, we did not take this picture. Most of our covers are stock photos taken from online photo sources. We have no control over their content other than accepting or rejecting a photo as appropriate. In this case, we failed to notice that the dentist was not wearing his facemask properly. For this, we apologize. It was an inadvertent oversight on our part. Please know we will work more diligently in the future so that such an error does not occur again.

D.D.S.
A Life of Service to Community and Profession

A Conversation with NYSDA President

David J. Miller, D.D.S.

David Miller, NYSDA President for 2015-2016, didn’t have a privileged upbringing, and his achievements in organized and hospital dentistry have not been without challenges. But determination and encouragement from others who foresaw his capabilities and talents got him to where he is today: the top elected official of the second largest dental constituency in the country and department chairman at a downstate medical center.

Perhaps it’s because he has had to work hard to get ahead that he has chosen to devote his professional life to helping the disadvantaged, the disabled, special needs patients and the countless others who society often forgets or overlooks. This includes rescuing abused and abandoned animals, a passion he shares with his wife, Patrice.

The first in his family to attend college, Dr. Miller said he reasoned that because he was paying for his education, he needed to work harder to succeed. Following his graduation from Georgetown University School of Dentistry, he entered the general practice residency program at Woodhull Hospital in Brooklyn. “During my residency, I realized there was so much more to learn, and it would be the first and last time I was paid to learn. This would set the stage for my advocacy for PGY-1 in New York State.”

What follows is more information about David Miller, gleaned from a recent conversation.
Can you tell us about yourself?

Where did you grow up?
Valley Stream, Nassau County, Long Island. My father, Robert, was a steamfitter, a union man. My mother, Loretta, was a dental assistant. I am the oldest of three children. I have a brother, Robert, and sister, Irene.

Where did you meet your wife?
Patrice and I attended the same high school, Valley Stream North. We were married during my second year at Georgetown. Patrice is an artist. She volunteers at Horse Ability, an equine assisted therapy center, and at the Town of Hempstead animal shelter. She is my office manager.

Children?
Patrice and I have four children. Patrice, 29, is a producer, choreographer and writer. Victoria, 27, is an actor, holistic health coach and teacher. Our son, David, 26, works with me at Interfaith Medical Center, where he’s director of emergency management. He has a master’s degree in public health and is an EMS Lieutenant in the fire department. Our daughter Elizabeth is 24, has a master’s degree in sociology and works for the Multiple Sclerosis Society.

Who was most influential in your becoming a dentist?
At first, it was Patrice’s father and mother, Dr. Patrick O’Malley, a podiatrist, and Genevieve, a teacher, who encouraged me to go to college. As for choosing dentistry to be my profession, that would be Vito Cardo, an oral and maxillofacial surgeon who lived next door to Patrice and her family and was my mentor. Dr. Cardo directed the oral surgery residency program at St. Mary’s Hospital in Brooklyn. He brought me there and allowed me to shadow him. The experience opened my eyes to dentistry, especially treating at-risk populations. Another thing that happened as a result of the time I spent at St. Mary’s, I got to witness the comfort and compassion delivered by the nuns and priests there. It’s something that stayed with me years later when I was attending Georgetown School of Dentistry and opted to do my rotation at D.C. General Hospital. It brought me into contact with the indigent, and I found I felt very comfortable treating these patients.

What do you do to relax/unwind?
Work out in the gym. Ride my bike. I like to garden, especially working with flowers. And spending time with my family exploring New York City and the natural beauty of Long Island.

What is your idea of a perfect day?
Time at the gym. A bike ride to the beach—I’ve always had an
affinity to the ocean; no matter the season or the weather, I feel most comfortable when I’m near the water. Then home for a swim in our pool, some wine and fish on the grill with my family and our dogs.

Did you ever imagine you would be president of NYSDA?
Certainly not when I first became involved with organized dentistry. And I became involved to find solutions to issues I encountered in my practice and in the hospital. I learned early on the importance of being at “the table,” where my voice was heard and I learned from leaders and mentors in our profession.

What are your goals for the coming year?
Growing membership is important. But I realize I have a short window of time to make a difference. I will focus attention on our special needs patients. This is why my President-elect’s conference, the “Oral Health Stakeholders Summit on the Future of Special Needs Dentistry” that took place in May in the Legislative Office Building in Albany was so important. We may not be able to affect the economics of care for this population, but we can fight to ensure quality dental care and access for New York’s most vulnerable patients. We can establish centers for medical and dental excellence, and CODA special needs residencies.
Dr. Miller is assisted in his East Meadow dental office by, from left: wife, Patrice, office manager; Eleanor Villar, dental assistant; Brittany Dracker, hygienist; Monique Midy, hygienist.

Dr. Miller with Bishop Joseph Sullivan, who was chairman of the Board of Catholic Medical Center of Brooklyn and Queens, and former New York City Mayor Edward Koch.

Dr. Miller and Gov. Andrew Cuomo. Award presented to Dr. Miller on being named distinguished physician of the year by St. Vincent Catholic Medical Centers of Brooklyn/Queens.

THE PARTICULARS

Employment
Chairman, Department of Dental Medicine, Interfaith Medical Center, Brooklyn.
General Dentist, East Meadow, Nassau County, Long Island.

Education
General Practice Residency, Woodhull Hospital, Brooklyn.
D.D.S., Georgetown University School of Dentistry, Washington, DC.
B.S., St. John’s University, Queens.

Professional Offices/Titles
Board of Directors, the Special Care Dentistry Association; Assistant Professor of Clinical Dentistry, New York Medical College, Valhalla; Assistant Clinical Professor of Dentistry, Columbia University School of Dental Medicine, New York.

Honors/Awards
St. Luke Medal for Distinguished Physician of Year, from St. Vincent Catholic Medical Centers of Brooklyn/Queens; recognized by City of New York Office of the Chief Medical Examiner for service as member of Dental Identification Team for the Sept. 11, 2001, World Trade Center and American Airlines Flight 587 disaster, Nov. 12, 2001; The NYSDA Bernard P. Tillis Award for editorial excellence; Fellow, American College of Dentists; Fellow, International College of Dentists; Fellow, Pierre Fauchard Academy.

Service to Community
Medical/dental mission to Columbia, South America; over a decade serving on the Board of Trustees of St. Francis Hospital, Mercy Medical Center and Catholic Charities Health System; Medical Reserve Corps; over a decade of volunteering for Give Kids A Smile; Mission of Mercy; Donated Dental Services; 30 years of treating special needs patients.

Addendum
- Dr. Miller’s first dental office was in a garage attached to the family home in East Meadow. He, his family and friends spent nights and weekends for a year to build it. His wife, Patrice, was the decorator. Dr. Miller currently occupies a more conventional office, also in East Meadow, that includes an apartment for his mother-in-law, Genevieve.
- Early on in his career, Dr. Miller proved he can succeed. Right out of his residency, he applied for the position of director of general practice residency program at Catholic Medical Centers of Brooklyn and Queens. The department chairman, Raymond Zambito, gave him the opportunity—and just one year to get the program accredited. He did. And he stayed there for 24 years, until the hospital system closed.
- David and Patrice share a commitment to rescuing and caring for abandoned and/or mistreated animals. Dr. Miller shares a vivid memory of the Christmas Eve he and his wife suspended plans for a family observance of the holiday to care for 20 therapy horses.
- Reflecting on the success he has achieved in his career, Dr. Miller acknowledges three people for making it possible. They are Vito Cardo, Raymond Zambito and Burt Wasserman. “I thank them for believing in me and giving me the opportunity,” he said.
- If he had to choose a life philosophy, Dr. Miller said it would be encompassed in the famous quote by Mahatma Gandhi: “The best way to find yourself is to lose yourself in service to others.”
Preparing and Restoring Composite Resin Restorations

The Advantage of High Magnification Loupes or the Dental Surgical Operating Microscope

John Mamoun, D.M.D.

ABSTRACT

Use of magnification, such as 6x to 8x binocular surgical loupes or the surgical operating microscope, combined with co-axial illumination, may facilitate the creation of stable composite resin restorations that are less likely to develop caries, cracks or margin stains over years of service. Microscopes facilitate observation of clinically relevant microscopic visual details, such as microscopic amounts of demineralization or caries at preparation margins; microscopic areas of soft, decayed tooth structure; microscopic amounts of moisture contamination of the preparation during bonding; or microscopic marginal gaps in the composite. Preventing microscope-level errors in composite fabrication can result in a composite restoration that, at initial placement, appears perfect when viewed under 6x to 8x magnification and which also is free of secondary caries, marginal staining or cracks at multi-year follow-up visits.

Use of microscope-level magnification, combined with co-axial illumination (MLMCI), may improve a dentist’s ability to prepare, bond, restore and adjust composite restorations, compared to the use of unaided vision and non-co-axial, shadow-forming overhead lighting. A co-axial light axis is coincident with the visual axis of the dentist’s eyes, resulting in shadow-free illumination.

Diagnosis and Removal of Dental Caries

MLMCI facilitates observation of the colors and textures of carious material and verification that a slow-speed round bur has removed all soft, carious tooth material from the margins and base of the preparation. Microscopically precise tactile sensitivity enables associating the feel of an explorer probing a soft carious point with the point on the preparation surface where the caries exists. MLMCI also makes possible detection of sub-gingival plaque, food particles or calculus that is contiguous with a preparation margin. And it aids in distinguishing this material from caries, stained but non-carious tooth structure or healthy marginal tooth structure.

MLMCI facilitates detection of microscopic caries at the contact points of inter-proximal surfaces and caries at the superior aspect of Class III preparations, as well as caries hidden underneath cusp tips or undercut areas of a posterior prepara-
tion. It assists in verifying removal of all sub-gingival decay from the apical aspect of the Class V preparation and in verifying that proximal box walls, margins and point angles of Class II preparations are free of carious material and chalky white demineralization. Co-axial lighting illuminates the apical aspect of the proximal box, which is boxed into a crevice formed by the sides of the proximal box, which hinders the shadow-free penetration of overhead lighting.

In cross-section, the grooves of posterior teeth have a V-shaped notch shape. If a preparation extends into a groove, and there is a V-shaped notch at the terminus of this groove aspect of the preparation, such as at the buccal extreme of a mid-buccal groove preparation aspect, then composite that is placed at this aspect may not flow intimately into the sharply angled notch (Figures 1, 2). This can result in a microscopic gap or a food or debris trap at the aspect of the restoration margin that is located at that preparation extremity, which may eventually result in a non-carious marginal stain. Also, caries, visible as a microscopic brown line embedded in a halo of chalky white demineralization, may exist on the inner surface of the preparation wall at the notch area and be contiguous with the apex of the V-shaped notch (Figure 2). Composite placed up against this notch may not only form a food trap, but this food trapping might also nurture the carious lesion, eventually resulting in a carious stain in this area.

MLMCI facilitates observation and rounding off of microscopic V-shaped notches at preparation extremities and removal of associated caries, including any microscopic vein of decay at the preparation base that also extends contiguously to the preparation margin (Figure 2). On maxillary anterior teeth, it enables detection of V-shaped notches and groove boundaries in cingulum grooves.

Creating Mechanical Retention in Preparation
Mechanical retention helps to reinforce a composite bond. MLMCI facilitates precise angling of a 330 bur or a 33½ bur to create mechanically retentive loci in a preparation. It helps verify that undercuts are distributed homogeneously throughout the preparation, and that for any particular direction of force that will be placed on the future restoration, there will be a locus of mechanical retention that will be able to resist that force. And it helps verify that an abfraction lesion preparation has a well-defined apical margin, and that the mesial and distal aspects of the preparation have well-defined, boxy edges.

Optimizing Bio-mechanical Stability of Composite Restoration
If a tooth presents with a carious hole on the occlusal surface or a marginal ridge, the dentist observes with MLMCI if an opposing pointy plunger cusp occludes directly into that hole. One example is a lingual cusp on a maxillary molar that protrudes more occlusally than the average level of the maxillary occlusal plane and that occludes into an opposing tooth such that the cusp tip is apical to the average mandibular occlusal plane. The dentist can use an aluminum oxide composite polishing bur to round off approximately 1 mm to 1.5 mm of the opposing protrusive cusp, ideally without exposing dentin. MLMCI facilitates verifying if all aspects of a preparation are deep enough to ensure that the resulting composite placed in the preparation will have adequate thickness to resist occlusal forces.

Matrix and Wedge
MLMCI facilitates the observation of microscopic gaps in the matrix band seal of a Class III preparation and helps in determining
whether a wedge of a different thickness, base width or position improves the seal. It helps in distinguishing between the inter-
ofaces of the wedge, the clear matrix band and the preparation
margin, and aids in observing if the apical aspect of the clear
matrix band wraps around the palatal-inter-proximal line angle
of the tooth being restored and is between the gingiva and the
tooth surface instead of on top of the gingiva or wrapping around
the neighboring tooth.

While pulling on a Class III matrix band to push the compos-
ite into the preparation, the dentist uses MLMCI to determine if
composite is flowing into all microscopic aspects of the prepara-
tion and margin and if microscopic adjustments to the direction
of pull on the clear matrix band improves the direction of com-
posite flow. Such microscope-level visual observation is useful if
malposition of the anterior teeth hinders the ability to firmly grip
the matrix band.

Isolating the Preparation
MLMCI helps clinicians detect microscopic amounts of moisture
contamination in the preparation and verify moisture removal
through air drying (Figure 3). A magnified view of the vestibules
allows a dentist to observe the rate of saturation of cotton rolls
and dry angles, which indicates at what rate these should be re-
placed. MLMCI also enables distinguishing the upward movement
of spatter into a maxillary second molar preparation from saliva
pooling in the mandibular retromolar pad area. And it helps the
dentist see the interface between tooth structure and the gingiva,
which prevents laceration of the gingiva during preparation of
marginal areas or when wedging matrix bands, thereby prevent-
ing blood contamination of the preparation.

Moreover, MLMCI aids in verifying that there is no moisture
seepage at the matrix band around Class II or Class III prepa-
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the bonding agent from wetting parts of the preparation. Some bonding experts suggest that a preparation surface has an optimal degree of wetness to effect bonding when the surface is slightly moist instead of being completely desiccated.\textsuperscript{25-27} And it aids in differentiating between degrees of preparation wetness, such as a desiccated surface, a slightly moist matte surface or a surface wet with pools of moisture.

Using Hand Instruments to Condense Composites
MLMCI allows a dentist to visually detect microscopic amounts of up-pull of a sticky composite increment by hand instruments when incrementally filling composite. Microscopically precise tactile sensation enables association of a feeling of up-pull with the angle of instrument placement and the depth of instrument tip penetration into the composite. MLMCI aids a dentist in detecting if such up-pull is due to microscopic amounts of composite flowing over undercut aspects of ball condensers or inverted cone condensers when the instrument tip is embedded in the composite material. A magnified view of the composite shows if it is flowing into all aspects of the preparation and if microscopic adjustments to the angle and direction of the hand instrument working tip directs composite flow into a required direction.

Bulk Filling Preparation with Composite
A basic technique of bulk filling is to use a composite applicator gun to slightly overfill the preparation with composite, then use a gloved finger, moistened with acid-free bonding agent or flowable composite (to prevent the gloved finger from sticking to the composite), to push the composite into the preparation. The dentist then releases the gloved finger from the composite and verifies, using MLMCI, that the finger did not up-pull any composite from the preparation and that the entire preparation perimeter is in contact with composite material. The dentist removes composite excess that has flowed past the sides or into the inter-proximal spaces of the tooth and then light-polymerizes the composite.

When bulk filling posterior occlusal-buccal preparations, where the occlusal and buccal surfaces are contiguous, MLMCI facilitates verification that the finger forces did not cause the composite at the occlusal-buccal line angle to lift up slightly, thereby creating a void under the composite at this line angle.

Handling Flowable Composite
MLMCI makes it possible to detect microscopic air bubbles in flowable composite, located either inside or on the external surface or margin of the flowable composite bolus. The dentist breaks

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up air bubbles with an explorer tip and observes, using MLMCI, that the flowable composite has settled into the space once occupied by the air bubbles. It allows a dentist to detect when an increment of flowable composite has flowed into complete contact with the surface of the preparation, or with the surface of composite over which the increment was placed (Figure 4).

Light Polymerization of Composite
MLMCI enables a dentist to differentiate between microscopic changes in the angle and direction of the polymerization light and in the distance from the restorative material to the light. The dentist can observe how microscopic changes to the light angle result in some microscopic aspects of the restoration that were not illuminated with previously utilized light angles to now become illuminated with other, different light angles. A dentist can visually estimate the location of each microscopic volume of the composite restoration, to ensure that each microscopic volume element of composite has been exposed to enough illumination to effect polymerization. In areas of minimal clearance, like the second molar areas, MLMCI allows a dentist to detect if microscopic aspects of a restoration are inaccessible to the polymerization light due to a non-ergonomic shape of the light tip.

Trimming and Polishing of Composite Restorations
MLMCI makes it possible to distinguish between the color of composite and the color of tooth structure. It allows a dentist to better estimate where the margin of the preparation is buried under an excess of composite material, by visually relating the location of various microscopic points along the preparation perimeter to microscopic morphological landmarks on the tooth surface. This facilitates trimming composite restorations to the preparation margins. Excess composite that extends beyond the preparation margin is essentially a thin flap that overlies the tooth surface. Food and debris may collect underneath the flap, eventually causing a carious or non-carious stain under the flap. At a postoperative visit, if the stain is non-carious, the dentist may be able to use MLMCI to detect and polish away the flap.

When polishing the facial surfaces of anterior teeth, magnification facilitates angling a triangle-shaped polishing bur so that multiple points on the bur contact the composite surface simultaneously, preventing divot formation on the composite surface. MLMCI enables a dentist to identify and remove microscopic pits in the margin of the finished composite or microscopically shallow concavities on an anterior facial composite that cause esthetically displeasing shadows to form on the surface.

MLMCI aids a dentist in detecting the inter-proximal margin of Class III composite and in distinguishing this margin visually from inter-proximal overhangs of composite material. It also facilitates detection of bonding agent that flowed into the gingival sulcus around an anterior tooth and hardened after light polymerization.
Microscopically precise tactile sensation enables a dentist to detect microscopic composite ledges or reliefs at the margin of Class V preparations and to precisely angle a triangle-shaped polishing bur in order to trim overhangs without ditching the composite margin. The dentist can directly observe if an explorer tip is closely hugging margin surfaces when detecting Class V overhangs. If polishing a Class V overhang abrades the gingiva, causing gingival bleeding, the dentist can smear the blood into the composite using an explorer tip and then observe, with MLMCI, if microscopic amounts of blood pool at overhang areas along the composite margin. This pooled blood is visible as a red line segment at margin overhangs.

Adjusting Occlusion
MLMCI facilitates identifying which opposing wear facets, cusp tips and fossa should mesh with one another with microscopic intimacy in maximum intercuspsation by observing to microscopically the perimeters of opposing wear facets and the microscopically topographical features of opposing tooth surfaces. The dentist then observes if grinding away articulating paper marks on the composite restoration results in an incremental microscopic decrease in the separation between opposing tooth surfaces.

MLMCI also aids in observing if the use of different brands or thicknesses of articulating paper, or the use of articulating paper on moist, versus dry surfaces, results in microscopic differences in the locations and sizes of articulating paper marks. The dentist can then determine which marks, produced under which circumstances, result in improvements in the articulation when the marks are reduced. If reducing articulating paper marks does not result in microscopic improvements of the occlusion, then the restoration may be optimally adjusted; however, if the occlusion is still off, the marks may be inaccurate. Here, the dentist can attempt to use MLMCI to directly observe pre-maturities that require reduction.

Conclusion
MLMCI may improve a dentist’s ability to detect and remove microscopic caries, microscopic amounts of moisture contamination or microscopic bio-mechanical compromising factors when preparing and restoring direct composite restorations. This may allow a dentist to produce composite restorations that, even after years of service, appear free of caries, stains or cracks when viewed under microscope-level magnification.

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Necrotizing Fasciitis Case Presentation and Literature Review


ABSTRACT
Necrotizing fasciitis is a rare, rapidly progressing infection with significant morbidity and high mortality rates. Rarely does necrotizing fasciitis appear in the head and neck region; rather, it usually affects the limbs and abdomen of patients. This article presents our institution’s experience with the disease and provides a discussion of proposed treatment options.

Necrotizing fasciitis is a rapidly progressing infection characterized by significant morbidity and high mortality rates. The description of necrotizing fasciitis dates back to the times of Hippocrates; it has been known by a variety of names: malignant ulcer, gangrenous ulcer, putrid ulcer, phagedenis ulcer, hospital gangrene and necrotizing cellulitis. In 1952, the disease was given its current name: “necrotizing fasciitis.”

Necrotizing fasciitis in the head and neck region is rare and represents a disease process clinicians may not have in-depth experience with. This article presents our institution’s experience with the disease and provides an additional case for the literature.

Case Report
A 48-year-old Hispanic male presented to our institution’s emergency room with a one-day history of right facial edema and pain, for which the oral and maxillofacial surgery service (OMS) was consulted. The patient denied history of trauma to the area. He reported a past medical history significant for hypertension and end-stage renal disease, for which he received dialysis three times a week. He also reported an unknown reaction to penicillin.

On physical exam, the patient was sitting upright in bed. There was significant right temporal, periorbital, canine, buccal, submental and bilateral submandibular edema, which was erythematous and extremely painful to palpation (Figure 1). The patient presented with a maximal incisal opening of 10 mm, which limited our ability to assess the floor of the mouth and posterior oropharynx. The patient’s dentition had multiple grossly carious, non-restorable teeth. A maxillofacial computer tomography with contrast was obtained. It demonstrated cellulitis of the right pre-septal facial region and submandibular regions. No focal fluid collection was noted (Figure 2). The patient demonstrated a white blood cell count (WBC) of 6.51 with 33% banding, platelets of 46,000, temperature of 102.8 and acceptable oxygen saturation. Despite his compromised medical condition, his electrolytes were acceptable for a patient with end-stage renal disease.

The patient was admitted to the medical intensive care unit (MICU) for facial cellulitis and airway observation until operating room time became available. Of paramount concern for this patient was securing his airway for surgery. Due to the loss of...
anatomic landmarks and deviation of the airway, a nasal fiber optic intubation was recommended and was successfully performed.

Surgical incision and drainage of right canine, temporal, submental and bilateral submandibular spaces, along with extraction of all non-restorable teeth were performed by the OMS service. The OMS service placed six Jackson-Pratt (JP) and one Penrose drain exposing the affected fascial spaces. Upon exploration of affected spaces, a dishwater-like discharge was noted from the affected spaces.

The patient remained nasally intubated in the MICU for the next several days (Figure 3). He received daily bedside wound care by the OMS service. This included evaluation of drain sites and irrigation of JP drains with normal saline. Based on clinical appearance, radiographic and laboratory findings, it was determined the patient was improving, and the drains were removed as they were no longer productive. The last of the drains was removed on the sixth postoperative day.

On the seventh day, the patient unexpectedly began to deteriorate into septic shock requiring vasopressor support. Because of his deteriorating condition, the patient was taken back to the operating room for further exploration and additional incision and drainage of wounds. Drains were placed in subcutaneous layers, where minimal resistance was felt with finger dissection, and areas of necrosis were debrided. The patient eventually required tracheotomy on hospital day 15 for treatment of acute respiratory distress syndrome and anticipated continued mechanical ventilation. The OMS service continued to perform daily wound care each day at bedside, consisting of irrigation and debridement of tissue as needed. On hospital day 33, the patient was taken to the OR for placement of a permacath to replace his clotted arteriovenous fistula by the general surgery service. The OMS team performed exploration of the wounds and further debridement of the area at this time.

The patient remained in the MICU for 37 days prior to being transferred to the pulmonary care unit, where he continued to receive daily bedside wound care by OMS (Figure 4). On hospital day 47, he was discharged to a sub-acute rehab facility. Upon his discharge, an area of tissue directly lateral to the right commissure was open, for which the OMS team had planned reconstruction of the affected area. Numerous attempts were made to have the patient follow up. Approximately six months after discharge, the patient returned to the OMS clinic. Upon examination, the area lateral to the right commissure had healed with an acceptable esthetic result to the patient; therefore, plans for the soft tissue reconstruction were abandoned (Figure 5).

In summary, the patient underwent three surgeries in the operating room, with culture swabs and tissue biopsies submitted. The cultures demonstrated beta hemolytic streptococcus group A (*Streptococcus pyogenes*). The infectious disease service

![Figure 1. Initial presentation.](image1)

![Figure 2. Initial computer tomography.](image2)

![Figure 3. Postop initial surgery.](image3)

![Figure 4. Preop photo before third surgery hospital day 26.](image4)

![Figure 5. Patient at six-month follow-up.](image5)
was consulted and directed antibiotic therapy. After evaluation of cultures, the infectious disease service tailored the patient’s antibiotic regime with amikacin (aminoglycoside), aztreonam (monobactam), clindamycin (lincosamide) and tigecycline (glycyclcycline). Hyperbaric oxygen therapy was recommended, but because of the patient’s unstable nature, he never received it.

The patient presented with a WBC upon admission of 6.51. He displayed minimal changes in his WBC following surgical intervention and during his stay in MICU. The lack of immune response contributed to the patient’s development of septic shock. As a result of the patient’s leukocytosis, infectious disease recommended Neupogen (filgrastim). Neupogen is a granulocyte colony-stimulating factor (GCSF) used for the treatment of neutropenia in patients undergoing chemotherapy.

**Discussion**

Necrotizing fasciitis is a disease process that results in liquefaction of the subcutaneous layer while sparing the overlying skin. If not treated early and aggressively, significant morbidity and mortality can occur.

A limited number of necrotizing fasciitis cases are reported yearly. Approximately 10% of reported cases occur in the head and neck region, with around 30% of patients being diagnosed correctly at the time of admission. Overall, mortality rates associated with all cases of necrotizing fasciitis are 46%; when of odontogenic origin, the mortality rate is 20%.3,4

Necrotizing fasciitis is generally considered a mixed aerobic/anaerobic polymicrobial infection; however, there are reported cases of monomicrobial infection.5 Several different bacteria are commonly isolated on microbiologic examination, including *Group A β hemolytic streptococcus (streptococcus pyogenes)*, *Clostridium perfringens*, *staphylococcus aureus* and *enterobacteriaceae*.6

The disease usually affects someone with immune dysfunction, such as diabetes, chronic malnutrition, or others with end-stage organ disease, trauma, burns and childbirth.7

Necrotizing fasciitis is characterized by rapid progression of subcutaneous necrosis affecting underlying fascia. It results in large amounts of edema along fascial planes. The disease typically starts two to four days following the initial injury. The injury may result from trauma, surgery, infections, contusions, abrasions, lacerations, peritonsillar abscesses, odontogenic infections and/or minor or forgotten injuries.8-12

The disease process can progress rapidly, initially appearing as an area of erythematous, edematous, hot, painful wound. The infected area can subsequently become numb due to compression and/or destruction of cutaneous nerves.13

The infection spreads rapidly via the subcutaneous fat and connective tissue layer, causing liquefaction of this layer. The liquefaction that occurs during necrotizing fasciitis is due to the breakdown of collagen by collagenase and hyaluronidase produced by *beta hemolytic streptococcus*, although multiple other organisms have been documented in wounds.6 The resulting necrosis of the overlying skin gives way to the characteristic offensive odor and dishwater-like pus.2 Venous return from the affected site decreases due to thrombosis of vessels, causing a pale color of the skin initially, followed by a purplish color then a black color, indicating ischemic necrosis.2 An intense inflammatory reaction occurs with a significant amount of polymorphonuclear infiltrates, focal necrosis and microabscess formation by the offending bacteria. The intense inflammatory response results in tachycardia, fever and, potentially, septic shock.2 Typically, the disease progresses along fascial planes and does not affect muscle. However, myositis (affected muscle) can be present and can cause devastating loss of tissue, resulting in exposure of bone.

If left untreated, this area of necrosis can rapidly progress along the fascial planes and descend into the neck and mediastinum.14,15 This greatly increases the risk of mortality.15 Evidence of descending necrotizing mediastinitis include: A. severe oropharyngeal infection; B. characteristic radiographic features of mediastinitis; C. documentation of necrotizing mediastinal infection; and D. establishment of relationship between oropharyngeal infection and descending necrotizing mediastinitis.14

Diagnosis of necrotizing fasciitis in the head and neck region at the time of presentation can be difficult. Clinical examination typically reveals minimal resistance to exploration of the subcutaneous tissues with a finger. Biopsy of affected tissue is of limited value due to necrosis; consequently, adjacent healthy looking tissue should be biopsied. According to Stamenskovic, use of frozen sections and the histologic appearance of dense polymorphonuclear infiltrates within the dermal layers confirm the diagnosis of necrotizing fasciitis.17 Computer tomography is the most commonly used radiographic method to evaluate the disease. Necrotizing fasciitis may demonstrate thickening and infiltrates of the cutis and subcutis, thickening of superficial and deep fascial planes, fluid collections, gas collections, mediastinitis and/or pleural/pericardial effusions upon radiographic examination.17

Balcerak has proposed staging of the necrotizing fasciitis based on cutaneous findings.19 Stage I, or early stages, consist of tenderness, erythema and swelling.18 The formation of blisters and bullae is characteristic of Stage II, or the intermediate stage.18 Stage III is the most devastating, and includes crepitus, skin anesthesia and necrosis.18

Suspicion of necrotizing fasciitis should warrant admission to the hospital for further work and initial antibiotic therapy. Of critical importance in patients with necrotizing fasciitis of the head and neck region is airway management due to the significant edema.19 Because of the potential difficulties that can be
encountered during intubation of a patient with necrotizing fasciitis, consideration should be given to a surgical airway. Should a surgical airway be required, care should be taken to avoid spread of the infection into the tracheotomy site.\textsuperscript{12} As our case demonstrated, edema can be quite extensive, causing obliteration of anatomic landmarks, which can make a tracheostomy very difficult. Early tracheostomy has been shown to shorten the length of mechanical ventilation, intensive care unit (ICU) stay and reduced complication rate.\textsuperscript{20,21}

Invasive hemodynamic monitoring, fluid resuscitation and vasopressor therapy may be required in the management of these patients due to sepsis and septic shock. Intravenous antibiotics will be required in the treatment of necrotizing fasciitis. Antibiotic therapy is guided by cultures; however, a triple antibiotic regime of penicillinase-/methicillinase-resistant penicillin, an aminoglycoside, and clindamycin or metronidazole is required.\textsuperscript{12,22}

The mainstay of treatment for necrotizing fasciitis remains aggressive surgical therapy. Wide surgical debridement should occur; tissue should be removed until areas of normal bleeding tissue are encountered without regard to reconstruction. Attempts at preservation of the facial nerve need to be made, if possible.\textsuperscript{23} Wound cultures and biopsies should be collected and sent for appropriate pathologic examination and used to direct antibiotic therapy. A variety of solutions have been proposed as wound irrigates, including 1% hydrogen peroxide and normal saline, eusol and Betadine.\textsuperscript{24,25,26} Wounds are irrigated daily and frequent wet-to-dry dressings applied to affected areas. The surgical wounds are left open or packed with gauze impregnated with antibiotics. The patient is consistently re-evaluated for development of areas of necrosis. According to Weiss et al., a patient will typically require three operating room visits for irrigation, debridement and packing of wound.\textsuperscript{14}

While surgical debridement and antibiotics are the mainstays of treatment, other adjunctive therapies have been suggested, including hyperbaric oxygen and vacuum-assisted closure devices. The use of HBO has been studied by multiple authors in conjunction with surgical therapy and has achieved good outcomes.\textsuperscript{27-29} The use of vacuum-assisted devices has been used for a variety of different wounds throughout the body. In recent years, use of vacuum-assisted devices as an adjunct for craniofacial injuries, including necrotizing fasciitis, has been described with good results.\textsuperscript{30} Our case presents a unique esthetic result not typically seen with secondary granulation of the affected area.

**Conclusion**

Initial management of patients with necrotizing fasciitis centers on airway management, with strong consideration given to a surgical airway if difficult airway is anticipated and/or prolonged mechanical ventilation is anticipated. After securing the airway, aggressive
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Adhesive Approach Using Internal Coping for Vertical Root Fractured Teeth with Flared Root Canals


ABSTRACT

Vertical root fractures are often observed in teeth with endodontic treatment and post space preparation. Frequently, because such teeth have flared root canals with thin dentin walls, conventional treatments are disadvantageous in terms of adheriveness, sealability and risk of refracture. Here we devised an intentional replantation method that uses internal resin coping, with a reinforcing effect on thin root canal dentin. In two patients treated with this method, satisfactory conditions have been maintained. This report suggests that an intentional replantation method in which an internal resin coping is employed may be a useful therapy for fractured teeth with flared root canals.

A vertical root fracture (VRF) is defined as a longitudinal fracture confined to the root that usually initiates on the internal canal wall and extends outward onto the root surface. VRFs are associated with pain, swelling, fistulas, tooth mobility, deep localized periodontal pockets and vertical bone defects; they cause progressive destruction of periodontal tissue. The prognosis for teeth with VRFs is extremely poor, and tooth extraction is recognized as the appropriate treatment in most cases. When a VRF occurs in an abutment tooth of a fixed or removable partial denture, large-scale prosthetic retreatment is often unavoidable. Therefore, establishing a way to prevent VRFs and thereby preserve root-fractured teeth would be of great clinical significance.

Among conventional therapies for VRF teeth reported thus far, adhesion methods that use adhesive resin cement, in particular 4-META/MMA-TBB dentin-bonded resin (SB: Super-Bond C&B; Sun Medical Co, Kyoto, Japan), have produced successful outcomes. Furthermore, the utility of adhesion methods using SB, which include bonding through the root canal, as well as extraoral bonding and replantation as conservative therapies for VRF teeth has become quite clear from histopathological and clinical investigations of these techniques.

VRFs due to trauma or excessive occlusal force are often observed in teeth with endodontic treatment and post space preparation. Frequently, such teeth have flared root canals with thin dentin walls. Thus far, however, there are no reports that focus on VRF teeth with flared root canals, which have poor long-term prognoses because their low fracture strength complicates adhesive processes and surgical maneuvers. Therefore, by applying Lui’s method, a
technique that produces beneficial outcomes by reinforcing thin dentin walls, we devised an intra-extraoral bonding and replantation method in which external bonding during intentional replantation is performed upon carrying out internal bonding by a resin coping procedure to reinforce thin root canal dentin (Figure 1).

Here we report two cases in which successful outcomes were obtained after performing this new adhesive replantation method on VRF teeth with flared root canals.

**Case One**

A 72-year-old man visited the Tokyo Medical and Dental University Hospital, Faculty of Dentistry, seeking full-mouth treatment. His primary complaint was occlusal discomfort. The patient presented with posterior bite collapse and loss of anterior guidance due to severe tooth decay and loss of tooth. His dental state was classified as Eichner Class B2 (two supporting zones). The treatment plan involved a full-mouth prosthesis with increased occlusal vertical dimension.

In the course of treatment, the post crown that had been fitted onto the maxillary right central incisor separated and a mesiodistal fracture line was confirmed. Periodontal pocket depth (PD) of 7 mm, bleeding on probing (BoP) and mesiodistal tooth movement were observed; a fistula had formed in the area corresponding to the buccal root apex (Figure 2). As loss of this tooth could potentially cause occlusal force imbalance following prosthesis, we decided to attempt a conservative treatment. Moreover, because this tooth had a flared root canal with a thin residual tooth structure, we applied an adhesive replantation method using internal coping.

After endodontic treatment and post space preparation, we took impressions with hydrophilic silicon and fabricated a model. After the cavity on the produced model was filled with dual-cure core resin (Estelite Core Quick; Tokuyama Dental Co., Tokyo, Japan), a fiber post (GC Fiber Post; GC Co., Tokyo, Japan), coated with a separating medium, was inserted to photo-cure the resin. Subsequently, the fiber post was removed, the internal coping was removed from the model, and light irradiation was performed (Figure 3).

After sandblasting and silane coupling treatments, the internal coupling was bonded to the tooth of concern with SB. Tooth extraction at the time of intentional replantation was performed carefully for periodontal tissue by using only diamond forceps (Figure 4). Bone loss and granulation tissue perpendicular to the mesiodistal direction were confirmed in the alveolar socket. The sulcus preparation on the fracture line to remove infection was carried out while injecting physiological saline and then sealed with SB. At the same time, an apicoectomy was performed and the root-end cavity was filled with mineral trioxide aggregate cement (ProRoot; Dentsply-Sankin K.K., Tokyo, Japan). The tooth was replanted into the alveolar socket after rotating it 90°.

After three months, core buildup was performed directly with the dual-cure core resin using a fiber post, and treatment transitioned to the final prosthesis. Currently, 2.5 years have elapsed...
and the patient has not complained of any symptoms. The periodontal pocket depth is 2 mm to 3 mm throughout the entire circumference and there is no BoP. X-ray photographs show a certain amount of mesiodistal bone resorption when compared with photographs taken after replantation. However, as there is no inflammation and the condition has not progressed, we are satisfied with the outcome thus far (Figure 5).

Case Two
A 72-year-old woman visited the hospital with ill-fitting dentures as her primary complaint. During the fabrication of treatment dentures, the crown separated along with the post. A fracture line was confirmed on the buccal side of the flared root canal (Figure 6). A PD of 7 mm and BoP were observed along the fracture line; moderate buccolingual tooth movement was noted. The residual dentin wall was remarkably thin throughout the entire circumference, so while tooth extraction was appropriate, we decided to attempt preserving the tooth because of the patient’s concern for aesthetics.

We planned to perform the adhesive replantation method using internal coping, followed by a prosthetic procedure with an attachment for dentures. The post space was formed by inserting a 0.02-tapered gutta-percha point (#130). The fabrication process is shown in Figure 7. Replantation was performed on a different day from the bonding of the internal coping (Figure 8). The tooth was placed in its original position without rotation when returned to the alveolar socket following apicoectomy due to root curvature. After three months, a magnetic denture attachment was fabricated and fitted with SB.

Currently, six months have elapsed. There have been no X-ray findings suggestive of an infection. And the patient shows no clinical symptoms, such as discomfort. Prognosis is satisfactory given that the PD in the fractured area is 2 mm and neither BoP nor tooth movement has been observed (Figure 9).

Discussion
Conventional treatments for VRF reported to date include a wire-binding splint technique, a screw fixation technique and bonding techniques that employ adhesive cements. Among these, an adhesion method using SB was first tested in 1982 by Masaka, who has obtained successful outcomes for over 10 years.

The biocompatibility and sealability of four types of adhesive resin cement used in bonding treatments, including SB, were evaluated by culturing human periodontal ligament cells on each type of cement and measuring the number of cells that adhered and proliferated. SB showed the greatest amount of cellular attachment and growth. In addition, the same four cements were tested in an experiment in which the cat tooth roots were extracted and fractured vertically, then bonded and replanted. Histopathological investigations four weeks later showed that inflammatory resorption and substitutive resorption were significantly lower for SB than for the other resin cements due to its high polymerization rate and the

Figure 4. Photograph of tooth extraction for Case One. Fracture line observed at arrow.

Figure 5. a) X-ray photographs for Case One at initial examination, 2 months after replantation and 2.5 years after replantation (from left to right). b) Intraoral view at 2.5 years after replantation. With periodontal pocket of 2-3 mm and no BoP, condition is favorable.

Figure 6. Intraoral view at time of vertical root fracture for Case Two.
low toxicity and residual percentage of its monomers. These results suggest the utility of SB for adhesive treatment of VRF.4

The success of adhesive treatment of VRF teeth is determined by the degree to which the healthy periodontal ligaments are preserved and postsurgical refracture is prevented. Here, when performing conventional treatment of a VRF tooth with a flared root canal, we considered the following problems: 1. The uncertainty of removing infection in the fractured area; 2. The uncertainty regarding scalability of the fractured area; 3. The risk of new fractures during replantation; 4. The influence of resin polymerization shrinkage on the thinned tooth structure; and 5. The risk of refracture after surgery. Given that these problems originate in thin root canal dentin with low fracture strength, we focused on Lui’s method,9 which reinforces the remaining tooth structure.

Lui’s method increases fracture strength by reinforcing the thinned wall of the root canal with a composite resin and further forming a small, tapered post space. The procedure involves inserting a fiber post coated in separating medium into the root canal filled with a composite resin, photo-curing the resin, removing the post and then directly/indirectly building up the core and post. This reinforcing technique has been verified by a number of studies. Yoldas12 evaluated stress transfer of different post and core systems to the cervical part of the artificially created flared root canals by using strain gauges. As a result, the resin reinforced specimens either with a cast post-core or pre-fabricated post, and the resin core transferred stress to the cervical part of the artificial roots at a rate lower than that of the conventional cast post-core system. Goncalves13 studied the fracture resistance of human maxillary incisors experimentally weakened roots reinforced with composite resins, compared with conventional systems that use cast and prefabricated posts. The fracture resistance reinforced by composite resins was greater than that reinforced by the cast posts, and comparable to the level of the control specimens.

The adhesive therapy we devised here yielded a tooth structure reinforcing effect and enabled the fracture line to be bonded and sealed with certainty. In addition, simplification of the surgical maneuvers required for intentional replantation in addition to reducing the extraoral treatment time, should also contribute to the preservation of the healthiest possible periodontal ligaments and, thereby, lead to successful outcomes. This therapy is likely to be appropriate for cases of VRF with partial separation, but not for cases of complete separation in which taking impressions for the production of internal coping is difficult. In the future, we plan to conduct follow-up studies of long-term prognoses and investigate whether a wider range of cases might benefit from therapy.

**Conclusion**

The adhesive replantation method devised here, which employs internal coping, can simplify surgical treatment and shorten extraoral treatment time, allowing for preservation of the healthiest possible periodontal ligaments. Moreover, the method reduces the risk of re-
fracture after surgery. These factors suggest that this method may be useful as a therapy for fractured teeth with flared root canals.

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Inflammatory Myofibroblastic Tumor of the Oral Cavity
A Great Mimicker

Nitesh Naresh, M.D.S; Ajay Malik, M.D.; Priya Jeyaraj, M.D.S.; Shashidevi Haranal, M.D.S.

ABSTRACT
Inflammatory myofibroblastic tumor (IMT) is a seldom-described tumor of indefinite etiology and pathogenesis. It occurs primarily in the lungs, but has occurred in other extra-pulmonary sites. Histologically, these lesions appear as an inflammatory infiltrate within a variably myofibrotic background. Current evidence shows that inflammatory myofibroblastic tumors are neoplastic processes resulting from chromosomal translocations that frequently cause an overexpression of ALK kinase, often assessed using immunohistochemical studies. Currently, the biological behavior of oral IMT is still uncertain. This article illustrates the clinical, histological and operative features of a case of IMT of the oral cavity.

IMT has many synonyms: plasma cell granuloma (PCG), inflammatory pseudo tumor (IPT), xanthogranuloma, histiocytoma and myofibrohistiocytic proliferation. The lung, gastrointestinal tract and orbit are the most common sites for IMT. It is an unusual lesion in the maxillofacial region and can easily be mistaken for a malignancy. The final outcome is based upon the histopathological diagnosis; and it has been reported in different sites of the oral cavity, i.e., gingival, tongue, buccal mucosa, palate, mandible and the salivary gland.

Case Report
A 70-year-old woman presented with a chief complaint of a gradually increasing, painless swelling in the left gingival-retromolar region for six months. Intraoral examination revealed a sessile, lobulated, round to oval, pinkish mass, firm in consistency, measuring 3 cm x 4 cm in the right gingivo-buccal area that was engulfing the lower left second molar tooth on the buccal aspect. The tooth was mobile (Figure 1A). The patient’s oral hygiene was poor, with multiple root stumps and mobile teeth. Her family history was noncontributory. No abnormalities were present in her general physical and systemic examinations. The panoramic radiograph showed no significant findings.

The patient gave a history of tobacco use in the form of mishri, a roasted tobacco powder, that she had been using since childhood to brush her teeth. She had changed back to toothpaste...
only a few months previously on the advice of the local dentist who had referred her to us, suspecting a malignant lesion. A differential diagnosis of fibroma, pyogenic granuloma, oral squamous carcinoma and verrucous carcinoma was made.

Owing to the size of the tumor and the anxiety of the patient, we decided to perform an excisional biopsy. The lesion was removed completely under local anesthesia, along with the associated tooth. A palliative periodontal Coe-pack dressing was placed over the surgical area to facilitate healing. The patient reported for regular follow-up for one month. Healing was uneventful, with no signs of recurrence. The entire excised lesion was sent for histopathological examination.

The H-E stained section showed parakeratinized surface epithelium, distinct fasciculated arrangement of collagen fibers interspersed with spindle to oblong cells. The background stroma showed focal myxoid and sclerotic areas. The inflammatory cells were an admixture of plasma cells, histiocytes and lymphocytes. No nuclear atypia or fungal organisms were detected (Figure 1B). Spindle cells were positive for vimentin and showed focal positivity for ALK-1 (Figure 1C, 1D); they were negative for CD-68, confirming that the spindle cells were myofibroblastic in origin.

**Discussion**

IMT manifests as an aggressive, recurrent lesion composed of a benign lympho-plasmacytic and myofibroblastic infiltrate. Clinically, it presents as a painless indurated mass or swelling of relatively short duration. It tends to occur more often in children and young adults.3,4

Although its histopathologic nature is benign, it may be difficult to differentiate this lesion from a malignant tumor because of its local invasiveness and its tendency to recur. The etiology and pathogenesis of IMT still remain a mystery. Some investigators consider it an immunologic host response to many different stimuli, including infectious agents, microorganisms, adjacent necrotic tissue, neoplasms, foreign bodies and some kinds of tissue injury.5 According to the World Health Organization, IMTs are classified as tumors of intermediate biological potential due to a tendency of local recurrence and a small risk of distance metastasis.6

Histologically, IMT is composed of interwoven fascicles of myofibroblastic spindle cells admixed with prominent infiltrate of lymphocytes and plasma cells. Three histological patterns that are described have no discernible association with the clinical behavior, namely:

- Myxoid/vascular pattern resembling inflammatory granulation tissue.
- Compact spindle cell pattern with fascicular and/or storiform areas with variation in cellular density.
- Hypocellular, densely collagenized and reminiscent of fibrous scar.
behaved as true malignant tumors. Yet rare cases may undergo spontaneous regression, as seen in the report presented here.1,7,8

**Conclusion**

We have described a case of a circumscribed tumor of the gingivo-buccal complex showing a proliferation of fibro-inflammatory nature, diagnosed as IMT, in a 70-year-old female that resolved after excision and has not recurred. However, IMTs are tumors with unpredictable clinical behavior, requiring complete surgical excision and continuous monitoring of clinical consequences. Therefore, it is important to recognize the distinction among similar appearing tumors in order to provide better guidelines for treatment and outcome.

Queries about this article can be sent to Maj. Naresh at Nitesh.naresh@gmail.com.

**REFERENCES**


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Segmental Dento-alveolar Intrusive Osteotomy in Posterior Maxilla with Lack of Inter-arch Distance for Prosthetic Rehabilitation

A Technique Combined with Sinus Floor Elevation


ABSTRACT

The aim of this paper is to present a technique for segmental dento-alveolar intrusive osteotomy in a posterior maxilla with lack of inter-arch distance for prosthetic rehabilitation combined with sinus floor elevation.

Methods: A full thickness flap is elevated exposing the lateral wall of the maxillary sinus. A lateral window is opened and the Schneiderian membrane elevated. Segmental dento-alveolar osteotomy is performed. After complete detachment of the segment, it is adapted and fixed to the new position using the pre-prepared guide, making sure not to damage or perforate the Schneiderian membrane.

Results: Four cases of segmental dento-alveolar intrusive osteotomy in a posterior maxilla combined with sinus floor elevation were performed utilizing the above-mentioned technique. All surgeries went according to plan, and healing was uneventful except for swelling and pain that lasted for 10-14 days post-operatively. The opposing dentition was later treated by implant placement. The average follow-up time for those cases was 5.4 months. Vitality test four months after surgery was positive.

Conclusion: The presented technique for segmental dento-alveolar intrusive osteotomy combined with sinus floor elevation can serve as a viable treatment option in the posterior maxilla with lack of inter-arch distance due to severe overeruption.

Patterns of tooth loss are changing throughout the population, with more patients remaining dentate until old age. During this time, a number of posterior teeth may be lost, leaving antagonists unopposed. As a consequence, a dramatic loss of inter-occlusal space following an extraction of an opposing tooth might be observed.1

Kiliaridis et al. identified that overeruption greater than 2 mm occurs in 24% of unopposed teeth, with 18% having no demonstrable overeruption at all. This leaves a total group with some overeruption of 82%, which, in terms of restoration, could have clinical significance.2
The unopposed upper first molar, in both healthy mouths and those with some periodontal pathology present, was studied by Compagnon and Woda. Their study showed that the majority of overeruptions occurred in the early years following opposing tooth loss. In later years, loss of periodontal support may be superimposed on the picture. In healthy individuals they noted that the gingival margin remained at its original level on the tooth during this occlusal tooth movement. The study found that after 10 years of remaining unopposed, this periodontal migration reversed and root exposure occurred. This was described by the authors as passive eruption. Craddock and Youngson reported that 83% of unopposed teeth are likely to overerupt, and that the extent of the overeruption may be marked. They have stated that the incidence and extent of overeruption is of clinical significance, not only in terms of treatment planning to prevent undesirable vertical movement, but also in restoration of the edentulous space.

Overeruption of upper molars because of the loss of antagonists may cause problems, such as periodontal defects and occlusal interferences. Clinically, overeruption of posterior teeth may complicate restoration of an edentulous space with either fixed or removable prostheses. In severe cases, most or all of the interocclusal space may be taken up by the vertical movement of the unopposed tooth, prohibiting restoration of the space without extraction of the overerupted tooth. The extent of overeruption will determine to what extent the overerupted tooth can be reduced or the occlusal plane modified.

To reconstruct the proper occlusion for the posterior dentition and to maintain periodontal health, an interdisciplinary and comprehensive dental treatment is necessary.

Correction of the overerupted molar is a first and essential step before other procedures can be started. Procedures such as orthodontic intrusion, prosthodontic reduction and surgical impaction have been presented. However, prosthodontic reduction requires endodontic intervention and crown restoration at the expense of tooth vitality, whereas orthodontic intrusion might be a difficult and prolonged treatment modality.

At the maxillary posterior area, the maxillary sinus might present a challenge when choosing the surgical impaction technique. Thus, the aim of this paper is to present a technique for segmental dento-alveolar intrusive osteotomy in a posterior maxilla with lack of inter-arch distance for prosthetic rehabilitation combined with sinus floor elevation.
membrane. Pre-prepared fixation plates are used to fix the segment to the adjacent bone (Figure 7). Bone graft and covering collagen membrane are placed on the operated site before primary closure is achieved (Figure 8). The surgical guide is then used as a splint, which is kept for 10 days. A postoperative panoramic radiograph is taken to demonstrate the new segment in place (Figure 9).

Results
Four cases of segmental dento-alveolar intrusive osteotomy in a posterior maxilla with lack of inter-arch distance for prosthetic rehabilitation combined with sinus floor elevation were performed utilizing the technique described above. All surgeries went according to plan, and healing was uneventful except for swelling and pain that lasted between 10 and 14 days postoperatively. The opposing dentition was later treated by implant placement and the occlusion restored properly. The average follow-up time for these cases was 5.4 months. Vitality test four months after surgery was positive for the non-root-canal-treated teeth.

Methods
In cases of severe maxillary molar overeruption, when proper occlusal rehabilitation is not achievable (Figure 1), the technique presented here can be utilized. Prior to the surgery, study models are prepared, and a mock-up surgery is performed on the model. This model is also employed for preparation of the surgical guide to be used for appropriate placement of the teeth during the surgery.

Under local anesthesia, a full thickness flap is elevated, exposing also the lateral wall of the maxillary sinus (Figure 2). A lateral window is opened (Figure 3) and the Schneiderian membrane separated and elevated, as in lateral sinus augmentation procedure. Segmental dento-alveolar osteotomy is performed using piezo-surgery (Figure 4). The line of the ostectomy is kept 4 mm to 5 mm above the teeth apices. Care is taken to preserve the mucoperiosteal attachment on the palatal aspect, which might be essential for the postoperative blood supply.

After complete detachment of the segment (Figure 5), it is adapted to the new position using the pre-prepared guide (Figure 6), making sure not to damage or perforate the Schneiderian membrane. Pre-prepared fixation plates are used to fix the segment to the adjacent bone (Figure 7). Bone graft and covering collagen membrane are placed on the operated site before primary closure is achieved (Figure 8). The surgical guide is then used as a splint, which is kept for 10 days. A postoperative panoramic radiograph is taken to demonstrate the new segment in place (Figure 9).
Correction of the overerupted maxillary molars can be achieved by orthodontic intrusion, prosthodontic reduction or surgical impaction. Each method has its pros and cons. Prosthodontic reduction usually requires endodontic intervention and crown restoration at the expense of tooth vitality; surgical impaction involves a rather major segmental operation; and orthodontic intrusion might be prolonged and demands calibrated anchorage support from intraoral multi-unit teeth and from extraoral headgear wear. Quite often, patients with localized problems do not perceive the extent of the treatment difficulty, which can require even a full arch strap-up to reinforce anchor units against two overerupted upper molars. Thus, the question of how to overcome localized problems with less cumbersome devices and only a partial arch strap-up with fixed edgewise appliance (for convenience, abbreviated as partial-fixed appliance) remains to be answered.

Conventional orthodontic treatment adequately corrects many overeruptions, but tends to be more acceptable for children and adolescents than for adults, mainly due to peer pressure and aesthetic considerations. Today, the incorporation of mini-implants, such as titanium miniscrews and miniplates, for skeletal anchorage might ease this treatment option, but a prolonged and rather complex orthodontic involvement is required.

This paper presents an optional technique for segmental dento-alveolar intrusive osteotomy in a posterior maxilla with lack of inter-arch distance for prosthetic rehabilitation combined with sinus floor elevation. This technique could serve in appropriate cases to solve the issue of overeruption and provide space for proper occlusal rehabilitation in a short time. However, it should be remembered that this is a surgical invasive technique that might lead to some postoperative complications and, as with any surgical procedure, it is not risk-free.

Careful case selection, followed by meticulous planning and appropriate surgical performance are very important in using the proposed technique.
The short duration of treatment and the use of the patient’s own teeth and tissues are two of the advantages of this option. Nevertheless, since these are only preliminary results of a limited number of cases, further long-term and large cohort studies are needed for additional assessment of this technique.

As with most conditions, however, prevention of the problem arising is often the best solution.\textsuperscript{11,12} Bearing in mind the processes involved in eruption, dentists may well wish to use some of the available techniques to predict, prevent, modify or treat undesirable tooth movements and thereby create a mechanical and biological environment more conducive to successful restorative treatment. Awareness of the likelihood of undesirable tooth movement following the loss of an antagonist may encourage practitioners to plan for the sequelae of tooth loss or, perhaps, to counsel their patients on the benefits of avoiding extraction.\textsuperscript{11}

Conclusions

The technique presented here for segmental dento-alveolar intrusive osteotomy combined with sinus floor elevation can serve as a viable treatment option in the posterior maxilla with lack of inter-arch distance for prosthetic rehabilitation due to severe over-eruption. Further long-term and large cohort studies are needed for additional evaluation of this technique.\textsuperscript{11}

No funding was received for this study, and the authors report no conflicts of interest. All authors contributed equally to this paper. Queries about this article can be sent to Dr. Levin at liranl@technion.ac.il.

REFERENCES

Comparison of Cone-beam Computed Tomography and Multi-slice Spiral Computed Tomography Bone Density Measurements in the Maxilla and Mandible


ABSTRACT

The purpose of this study was to compare cone-beam computer tomography (CBCT) and multi-slice spiral computed tomography (MSCT) bone density measurements in the maxilla and mandible to determine whether any discrepancies between imaging modalities exist. Material & Methods: 33 sets of CBCT and MSCT scans were evaluated using Simplant software. Density measurements were made in eight regions of interest on each scan and were compared and analyzed. Results: Correlation of density measurements at specific regions of interest between CBCT and MSCT was only fair and ranged from 0.61-0.86. High-density areas, such as the anterior mandible, showed a higher correlation between imaging modalities than low-density regions, such as the posterior maxilla. Conclusion: Care should be taken when relying upon CBCT to determine bone density, especially in low-density regions such as the posterior maxilla.

Accurate, three-dimensional diagnostic imaging is essential for performing many oral and maxillofacial surgical procedures. The most common three-dimensional imaging modalities employed by oral surgeons today are multi-slice spiral computed tomography (MSCT) and cone-beam computed tomography (CBCT). There are clear benefits to CBCT over MSCT. These include diminished radiation exposure, increased accessibility and reduced costs. However, MSCT is far superior in visualizing soft tissue, which is why it remains the gold standard in maxillofacial imaging.

The development of in-office CBCT devices over the last decade has caused many practitioners to rely primarily on CBCT imaging for evaluating hard tissue, especially as it relates to dental implant placement and related bone grafting. Of most importance in dental implant surgery planning is determining the quantity and quality of bone, as well as the location of certain anatomical structures. Bone quantity can be measured linearly. Several studies have evaluated the accuracy of linear measurements, as well as volumetric measurements in CBCT and have found sub-millimeter accuracy and no significant differences when compared to MSCT. Multiple studies have also evaluated the ability to identify and locate important anatomical structures, such as the inferior alveolar neurovascular canal and its associated foramina, and have found no significant differences between CBCT and MSCT. However, controversy remains regarding the accuracy of CBCT when evaluating bone.
density, especially in low-density medullary bone, which is of critical importance for predicting the stability and success rate of dental implants.\textsuperscript{15,16}

The aim of this study was to compare CBCT and MSCT bone density measurements in the maxilla and mandible to determine whether significant discrepancies between imaging modalities exist.

**Materials and Methods**

Since 2003, CBCT imaging has been performed in the Montefiore Medical Center Oral and Maxillofacial Surgery Clinic. The Einstein Institution Review Board (IRB) approved this study. Many of the patients who have undergone CBCT imaging in the clinic have also undergone MSCT imaging by the Department of Radiology \textit{(GE Lightspeed VCT 64-Slices)}. A list of all maxillofacial clinic patients that have had CBCT imaging was cross-referenced with a list from a hospital database of all patients who have had maxillofacial MSCT imaging to derive a list of patients that had both MSCT and CBCT imaging of the maxillofacial region within a one-month period of each.

Data from 33 patients with sets of acceptable CBCT and MSCT scans were selected for analysis provided the following exclusion criterion was met: If a jaw fracture or pathologic lesion (i.e., tumors, cysts, fractures) was present at any region of interest (ROI), the ROI was not included in the data. The DICOM data of the axial images from each of the scanner types was then loaded into the three-dimensional visualization software \textit{(Simplant, Materialize Dental Inc., Glen Burnie, MD)} and Hounsfield Unit (HU) measurements were taken at five ROI in the mandible and three ROI in the maxilla using a 10 mm\textsuperscript{2} circular field in the cross-sectional view. The measurements in the mandible were taken mid-alveolus 3 mm apically to teeth #22, #25 and #27, and bilaterally 2 mm posterior to the most distal tooth at 8 mm inferior to the alveolar crest. Measurements in the maxilla were taken mid-alveolus posterior to A point and bilaterally 2 mm posterior to the most distal tooth at 2 mm superior to the alveolar crest (Figure 1). Each set of DICOM data was measured twice to evaluate the amount of measuring error due to any potential difficulty finding and measuring the same region of interest. A total of 701 density measurements were recorded from 33 CBCT scans and 33 MSCT scans.

**Statistical Analyses**

Power analyses were performed based on published differences (Dahmani-Causse, 2011) \textsuperscript{6} for $\alpha$=.05, two-tailed test with 80\% power. Means and standard deviations are presented for MSCT and CBCT, as well as for the differences between MSCT and CBCT and for the absolute difference. Means for the actual differences were derived to detect any bias from zero, and means for the absolute differences were derived to determine the magnitude of discrepancies between the MSCT and CBCT. Intraclass correlation coefficients (ICC) were computed between MSCT and CBCT values to assess degree of agreement; Wilcoxon Signed Rank tests.
were conducted to determine whether raw differences differed significantly from zero. All tests of significance were two-tailed and conducted at $\alpha = .05$.

**Results**

The means and standard deviations for CBCT and MSCT are presented in Table 1 and Table 2, respectively, for each of the eight regions. When the same eight regions were measured twice on the same scan, by the same individual, the agreement between HU values ranged from .93 to .99 when measuring CBCT scans, and between .92 to .99 when measuring MSCT scans (Table 3). This indicated a high degree of intraclass agreement and minimal measurement error associated with locating and measuring the same regions of interest twice. Therefore, any differences between CBCT and MSCT values due to variability identifying the same region of interest are expected to be minimal.

However, correlation of density measurements between imaging modalities was only fair. Intraclass correlation ranged from .81 to .89 in the mandible and .61 to .81 in the maxilla (Table 3). It was noted that the lower the mean HU value of a ROI, the lower the correlation there was between imaging modalities. The mean HU of the left distal molar maxilla was -42.9 on CBCT and 104.7 HU on MSCT, which resulted in a coefficient of correlation of .69. In contrast, in the denser regions, such as the anterior mandible, where mean HU values ranged from 508 to 660, the intraclass correlations all exceeded .85.

Closer evaluation revealed that MSCT HU values were consistently higher than CBCT HU values for all but one of the regions of interest. When the two lowest density reference points in the posterior maxilla were disregarded, mean HU values between imaging modalities related to each other, but MSCT values were 21.5% higher than

### Table 1
**CBCT**

<table>
<thead>
<tr>
<th>ROI</th>
<th>N</th>
<th>Mean (HU)</th>
<th>Std Dev</th>
</tr>
</thead>
<tbody>
<tr>
<td>Right Canine Mandible</td>
<td>29</td>
<td>456.8</td>
<td>202.2</td>
</tr>
<tr>
<td>Left Canine Mandible</td>
<td>28</td>
<td>445.9</td>
<td>237.6</td>
</tr>
<tr>
<td>Right Central Mandible</td>
<td>31</td>
<td>586.2</td>
<td>228.9</td>
</tr>
<tr>
<td>Right Distal Molar Mandible</td>
<td>25</td>
<td>317.5</td>
<td>198.7</td>
</tr>
<tr>
<td>Left Distal Molar Mandible</td>
<td>25</td>
<td>234.4</td>
<td>203.9</td>
</tr>
<tr>
<td>Point A Maxilla</td>
<td>25</td>
<td>415.0</td>
<td>225.1</td>
</tr>
<tr>
<td>Right Distal Molar Maxilla</td>
<td>20</td>
<td>7.3</td>
<td>195.9</td>
</tr>
<tr>
<td>Left Distal Molar Maxilla</td>
<td>22</td>
<td>-42.9</td>
<td>190.6</td>
</tr>
</tbody>
</table>

### Table 2
**MSCT**

<table>
<thead>
<tr>
<th>ROI</th>
<th>N</th>
<th>Mean (HU)</th>
<th>Std Dev</th>
</tr>
</thead>
<tbody>
<tr>
<td>Right Canine Mandible</td>
<td>20</td>
<td>508.5</td>
<td>245.2</td>
</tr>
<tr>
<td>Left Canine Mandible</td>
<td>21</td>
<td>518.8</td>
<td>309.9</td>
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<td>Right Central Mandible</td>
<td>23</td>
<td>663.4</td>
<td>257.9</td>
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<td>Right Distal Molar Mandible</td>
<td>13</td>
<td>399.3</td>
<td>260.4</td>
</tr>
<tr>
<td>Left Distal Molar Mandible</td>
<td>16</td>
<td>211.7</td>
<td>184.1</td>
</tr>
<tr>
<td>Point A Maxilla</td>
<td>20</td>
<td>605.4</td>
<td>213.4</td>
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<tr>
<td>Right Distal Molar Maxilla</td>
<td>13</td>
<td>104.8</td>
<td>156.9</td>
</tr>
<tr>
<td>Left Distal Molar Maxilla</td>
<td>15</td>
<td>125.3</td>
<td>227.4</td>
</tr>
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</table>

### Table 3
**Intraclass Correlation Coefficients**

<table>
<thead>
<tr>
<th>ROI</th>
<th>CBCT1 vs CBCT2</th>
<th>MSCT1 vs MSCT2</th>
<th>CBCT vs MSCT</th>
</tr>
</thead>
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<tr>
<td>Right Canine Mandible</td>
<td>0.98136</td>
<td>0.97376</td>
<td>0.85541</td>
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<td>Left Canine Mandible</td>
<td>0.99366</td>
<td>0.96107</td>
<td>0.88042</td>
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<td>Right Central Mandible</td>
<td>0.98877</td>
<td>0.97083</td>
<td>0.85517</td>
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<td>Right Distal Molar Mandible</td>
<td>0.9597</td>
<td>0.95719</td>
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<td>Left Distal Molar Mandible</td>
<td>0.98133</td>
<td>0.9453</td>
<td>0.88603</td>
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<td>Point A Maxilla</td>
<td>0.98245</td>
<td>0.92706</td>
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<td>Right Distal Molar Maxilla</td>
<td>0.98689</td>
<td>0.93684</td>
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<td>Left Distal Molar Maxilla</td>
<td>0.93112</td>
<td>0.98766</td>
<td>0.61644</td>
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</table>

### Table 4
**Absolute Differences Between MSCT and CBCT**

<table>
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<tr>
<th>ROI</th>
<th>N</th>
<th>Mean</th>
<th>Std Dev</th>
<th>Median</th>
<th>Min</th>
<th>Max</th>
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<tbody>
<tr>
<td>Right Canine Mandible</td>
<td>20</td>
<td>81.6</td>
<td>83.8</td>
<td>46.9</td>
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<td>Left Canine Mandible</td>
<td>21</td>
<td>106.0</td>
<td>84.5</td>
<td>71.1</td>
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<td>Right Central Mandible</td>
<td>23</td>
<td>105.2</td>
<td>73.5</td>
<td>94.9</td>
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<td>320.8</td>
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<td>Right Distal Molar Mandible</td>
<td>13</td>
<td>116.5</td>
<td>72.4</td>
<td>103.1</td>
<td>16.7</td>
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<tr>
<td>Left Distal Molar Mandible</td>
<td>16</td>
<td>70.9</td>
<td>54.6</td>
<td>53.2</td>
<td>2.1</td>
<td>215.1</td>
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<tr>
<td>Point A Maxilla</td>
<td>17</td>
<td>110.0</td>
<td>64.2</td>
<td>123.5</td>
<td>11.5</td>
<td>223.4</td>
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<tr>
<td>Right Distal Molar Maxilla</td>
<td>13</td>
<td>128.9</td>
<td>79.1</td>
<td>147.1</td>
<td>17.5</td>
<td>246.2</td>
</tr>
<tr>
<td>Left Distal Molar Maxilla</td>
<td>15</td>
<td>185.2</td>
<td>85.6</td>
<td>180.6</td>
<td>22.6</td>
<td>347.7</td>
</tr>
</tbody>
</table>
TABLE 5
MSCT Percentage Greater than CBCT

<table>
<thead>
<tr>
<th>ROI</th>
<th>Mean absolute difference</th>
<th>MSCT % greater than CBCT</th>
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<tr>
<td>Right Canine Mandible</td>
<td>81.6</td>
<td>16%</td>
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<tr>
<td>Left Canine Mandible</td>
<td>106.0</td>
<td>20%</td>
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<tr>
<td>Right Central Mandible</td>
<td>105.2</td>
<td>16%</td>
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<tr>
<td>Right Distal Molar Mandible</td>
<td>116.5</td>
<td>20%</td>
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<tr>
<td>Left Distal Molar Mandible</td>
<td>70.9</td>
<td>33%</td>
</tr>
<tr>
<td>Point A Maxilla</td>
<td>110.0</td>
<td>18%</td>
</tr>
<tr>
<td>Right Distal Molar Maxilla</td>
<td>128.9</td>
<td>120%</td>
</tr>
<tr>
<td>Left Distal Molar Maxilla</td>
<td>185.2</td>
<td>148%</td>
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</table>

the mean CBCT HU values with a range of 15% to 32% higher (Table 5).

Discussion
Three-dimensional imaging is essential for performing many oral and maxillofacial surgery procedures. Cone-beam computed tomography and multi-slice computed tomography are the imaging modalities most commonly utilized by oral and maxillofacial surgeons. Many practitioners are relying increasingly on CBCT imaging due to decreased costs, increased accessibility and decreased radiation exposure to patients when compared with MSCT. Other studies have compared the accuracy of linear distance measurement and the ability to identify important anatomical structures, such as the inferior alveolar neurovascular canal, and have found no significant differences between MSCT and CBCT. However, MSCT is superior for evaluating low-density tissues and controversy remains regarding the accuracy of CBCT when evaluating bone density, especially in low-density medullary bone, which is of critical importance for predicting the stability and success rate of dental implants.

In this study, bone density measurements were made at specific regions of interest in the maxilla and mandible in both CBCT and MSCT scans of the same patient taken within 30 days of each other. When a region of interest was measured twice on the same CBCT or MSCT scan, there was a high degree of correlation between HU values obtained, which indicated that the ability to relocate and measure the same anatomical region of interest was excellent. However, upon comparison of CBCT and MSCT scans of the same patient, there was a marked discrepancy in Hounsfield values between the different imaging modalities.

Regions of interest that are typically denser bone, such as the anterior mandible, showed much higher HU value correlations between imaging modalities than regions of interest in the posterior maxilla and mandible, which are typically very low density areas. Closer evaluation revealed a trend of MSCT measurements being higher than CBCT measurements and, when analyzed as a whole, MSCT measurements were approximately 20% greater than their CBCT counterparts. However, definitive statistical relationship between the two was not found.

Based on this study, practitioners should use caution when relying on CBCT imaging to evaluate areas of low-density bone in the maxilla and mandible, especially as a predictive tool for successful osseointegration of dental implants, which is highly related to bone density.

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References

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Standards, Regulation and Registration of Dental Laboratories
An Industry Update

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ABSTRACT
State dental associations are showing increased interest in maintaining current standards and regulations affecting the dental laboratory industry as mandated by the Food and Drug Administration. The domestic dental laboratory industry is being significantly stressed by foreign competition, rapid technology development and unprecedented consolidation, which are changing the way that prosthetic devices and restorations are manufactured and delivered to dentists. Of paramount importance to the prescribing dentist is the accurate documentation of the source and materials being used in prostheses being delivered to patients.

During its 2014 Annual Session, the ADA House of Delegates approved a resolution calling on individual states to encourage their state boards to register dental labs within their jurisdictions. Dental laboratory registration is currently required in nine states. There are another seven states exploring legislation to require dental laboratory registration. Material disclosure and identification of origin of manufacture are of paramount importance.1

Dental laboratory compliance with the Food and Drug Administration is not optional. All commercial dental appliance manufacturers must comply with FDA Title 21 CFR Part 820 regulations, which specify that covered entities have good manufacturing practices (GMPs). These include an established, documented "Quality System for the design, manufacture, packaging, labeling, storage, installation and servicing of finished medical devices intended for commercial distribution in the United States."2 While these regulations have been in effect since 1997, in recent years, the FDA has begun inspecting U.S. dental laboratories to ensure compliance. While all dental laboratories must comply with FDA regulations, domestic dental labs, for the most part, do not have to be registered with the FDA.

Dental labs that must register with the FDA include:
1. All domestic and foreign labs that repackage or relabel materials.
2. All domestic and foreign labs that fabricate sleep apnea or snoring devices.
3. All foreign dental laboratories shipping into the United States.
4. All domestic labs that ship directly to and from foreign dental labs.

Congress passed the Medical Device User Fee Stabilization Act in August 2005, making it a requirement that labs identify restorations and dental appliances that they distribute but do not manufacture. If XYZ dental laboratory outsources to either a domestic or foreign lab that makes all or any part of the restoration or dental appliance, it must clearly label that it is "Distributed by XYZ" and disclose the point of manufacture origin.3 Title 21 CFR Part 820 also requires that dental laboratories maintain identification/traceability of all patient contact materials. The dentist and laboratory must be able to identify and track all patient contact materials back to the original material manufacturers. Lot numbers should be included in material disclosures so that
a particular batch of materials may be identified and potentially isolated in the event of adverse reactions. All forms should be in duplicate (Figures 1, 2, 3).

The most recent data from the Department of Labor showed there were 7,042 dental laboratories generating a payroll in 2011; that data represents a 20% reduction of domestic dental laboratories in the two years from 2009 through 2011. A study conducted by the National Association of Dental Laboratories (NADL) revealed a 39% decrease in domestic dental laboratories from 2006 projected through 2017. Foreign competition and rapid changes in technology are big factors. For example, 25% of all domestic dental laboratory sales and almost 40% of actual restorations are currently manufactured overseas, according to NADL. There are 42 countries that currently have foreign dental laboratories registered with the FDA.

Mass digitization of the dental laboratory industry is in full swing, and labs need to become digital to stay competitive. CAD/CAM increases efficiency, accuracy, consistency and capacity. Production per technician increases exponentially; however, when accounting for capital investment costs, raw materials, software licensing fees, dongle fees, maintenance fees and equipment upgrades, there is decreased profitability at today’s competitive market prices. Digitally capable labs are basically working with the same possibilities in terms of materials, processing speed and quality.

Dental laboratories need to adapt with strong business models to develop or maintain customer loyalty. According to sales statistics provided by manufacturers of CAD/CAM ceramic blocks for “in office” milling, in 2014, there were over two million ceramic crowns produced in dentists’ offices. While the dental laboratory industry does not view this as a huge threat to dental laboratory technicians, the reality is that volume alone eliminates close to 1,000 ceramist jobs.

There are three phases in the industrialization of almost all manufactured products: handmade, assembly line production and automation. Large multinational dental laboratories and corporations, whether privately held or publicly traded, are well positioned not only to drive pricing down, but also to drive the rapid digitization and automation of dental laboratory procedures. With the accuracy, consistency and efficiency that come with CAD/CAM technology, well-capitalized companies have a lot of capacity. And they are increasing market share by shifting more and more financial resources toward branding and mass marketing instead of toward mergers and acquisitions.

A big part of the pricing pressure problem facing domestic and traditional dental laboratories is supply. Capacity has never been higher and dental lab sales are stagnant. Even large manufacturers and suppliers of raw dental materials are now heavily invested in automation. They process thousands of units a day for outsourcing domestic dental laboratories. The high cost of “in house” processing of raw materials like prosthodontic alloys and
ceramic material make partnering with large vendors very appealing. The long-term economic downturn has also played a role in consolidation. Rolling back employee insurance benefits and intense competition for disposable income directly affects approval rates for elective and cosmetic dentistry.

Summary
The domestic dental laboratory industry will continue to change drastically. Foreign competition, rapid development of new technology and consolidation are the leading factors in this “adapt or die” business environment. Even with thousands of dental laboratory closings in the past few years, prostheses fabrication capacity has skyrocketed. Pricing pressure will continue to drive down profitability and cause traditional domestic dental laboratories that do not adapt quickly to fail. Material processing will continue to shift from small local domestic dental labs to large multinational dental laboratory operations and corporations that are well capitalized and heavily invested in technology.

Does this state need dental laboratory registration? In a recent discussion between several New York State dental laboratory owners and members of the NYSDA Council on Dental Education and Licensure (CDEL), it was generally agreed that increased regulation of the dental laboratory industry in New York would not necessarily result in further protection of the public. Education of NYSDA members and dental laboratories located in this state regarding documentation of patient contact materials and point of fabrication origin is needed and should be a priority.
The best advice for safeguarding patients and protecting a dental practice from unforeseen liabilities due to poor or inferior dental laboratory-produced products is to be well informed. There are no FDA standard compliance forms. Dental laboratories are expected to develop their own product specific disclosure forms as part of their GMPs and quality systems. Make sure you receive the following paperwork from your dental lab with each and every case: infection control documentation, identification of materials (IdentAlloy and IdentCeram stickers, 510K’s, FDA and ADA material approvals) and disclosure of manufacturing origin. Dental laboratories must also disclose to a dentist if any portion of the restorations and/or prosthetic devices is outsourced to other manufacturers.

Dentists want to know, and providing the proper documentation and traceability is a matter of FDA compliance and public safety. 

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