

AMERICAN ACADEMY  
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SURGEONS



## CITATION DYNAMICS: THE MOST CITED PUBLICATIONS IN ORAL & MAXILLOFACIAL SURGERY

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**BACKGROUND:** Citation is one of the most important forms of acknowledgment and recognition received by our peers in academia. This study identifies and characterizes the current top most highly cited publications in journals dedicated to our specialty. The purpose of this review is to provide insight into the direction the specialty has taken in the last 30 years.

**METHODS:** We selected four journals that were dedicated to the field of Oral & Maxillofacial Surgery (OMFS). The SCOPUS database was utilized to perform a citation analysis on the top 200 publications in the month of February 2015. Each publication was individually reviewed for the number of citations, the source journal of the manuscript, its year of publications, the article type, the country of origin, the study type, the level of evidence. We categorized every manuscript within a sub-specialty.

**RESULTS:** The number of citations ranged from 1134 to 92. Majority of the manuscripts were published in the Journal of Oral & Maxillofacial Surgery (63%) followed by the International Journal of Oral and Maxillofacial Surgery (22.5%). Only 2.5% of these publications were of level I evidence. The most frequent field of publication was benign pathology (20%) followed by dental implants (17.5%) and then craniofacial trauma (11.5%). Majority of the publications were articles, of which 61.5% were case-control, case series or cohort studies. Interestingly 10 of the top 20 most cited articles were related to osteoradionecrosis, osteochemonecrosis and bisphosphonates. Majority of these publications originated in the USA (37.5%), followed by Germany (8%), the Netherlands (8%), Sweden (8%).

**CONCLUSION:** Despite considerable advances in the quality of both clinical and laboratory research, only five Level I studies were identified. Osteonecrosis/bisphosphonates and platelet-rich plasma were frequent topics indicating the recent interests in these fields. The USA has continued to play a major role in research, however there needs to be more international, multi-institutional cooperative collaborations.

## INCORPORATION OF MILESTONES INTO THE OMS RESIDENCY CURRICULUM

**AUTHOR:** Vincent Carrao, DDS

A milestone is a developmental goal that is achieved or not achieved. The incorporation of educational milestones into the oral and maxillofacial surgery curriculum is a process that is on the horizon. The milestone model for medical education has been pioneered by the ACGME to improve, standardize and provide an outcome assessment for resident education.

Resident educational milestones can be incorporated in each teaching center with the help of all the oms teaching staff at an accredited program. The teaching staff can provide subjective input related to the milestones on a semi-annual basis. The milestone grading scale that has been suggested is a grade from level 1 to level 4 with progressive learned skills that can be correlated to the residents post graduate year of training. If a resident seems to have deficiencies in a specific milestone, the issues can be addressed with focused teaching to help the resident receive the best education possible. This process will provide residents and programs with an ongoing assessment of resident education and program efficiency. As with all new assessment tools there may be obstacles incurred on gathering data and more importantly how will program directors utilize the information collected.

## **SURGICAL SIMULATION: A PARADIGM SHIFT FOR ORAL AND MAXILLOFACIAL SURGERY TRAINING, CONTINUING EDUCATION, AND CERTIFICATION MAINTENANCE**

**AUTHOR:** Daniel J. Meara, MD, DMD, FACS

**PURPOSE:** Current practice involves the Halstedian model of "see one, do one, teach one" in the context of real patient care. The focus is on safe and optimal patient care and not surgical education, practice and improvement. Thus, the goals of the presentation are: 1) explain surgical simulation and its role in the future of residency education, continuing education, and certification maintenance, 2) incorporate concepts and principles of simulation into residency training, and continuing education programs, and 3) adopt a team or office-based approach toward skill practice and emergency preparedness, utilizing a simulated environment, with the learner or team, not the patient, as the focus of the process.

**MATERIALS AND METHODS:** Simulation methodologies are applied to Oral and Maxillofacial Surgery residency education and applied in the virtual education and simulation training (VEST) center at Christiana Care Health System, in Wilmington, Delaware.

**RESULTS:** Simulation enhances competence and creates a structured approach to training. Further, patient safety and quality of care is improved by elimination of "see one, do one, teach one" methodologies. Objective improvement is achieved in knowledge and technical skill, via deliberate practice, and can be measured via checklists and objective structured clinical examinations.

**CONCLUSION:** The educational gap is the teaching model and environment as well as the inability to have on-demand practice in the acquisition of surgical skill and competence. The ability to learn on-demand, out of the operating room and on a virtual patient, ultimately allows for the delivery of safe and enhanced clinical care, in real-time, for patients. Further, the surgeon, in-addition to the patient, is the beneficiary as the surgeon can: 1) learn new skills 2) practice and prepare for rare events, and 3) use simulation to re-educate on less frequency performed procedures. Also, a team approach to skill practice or emergency preparedness can be achieved. In summary, simulated surgical education is undertaken in a virtual environment that focuses on the learner and allows for errors and practice in the acquisition of knowledge and skill.

## HOW DO QUANTITATIVE MEASURES OF RESEARCH PRODUCTIVITY CORRELATE WITH ACADEMIC RANK IN ORAL AND MAXILLOFACIAL SURGERY?

**AUTHOR:** Zachary Peacock, DMD, MD

**MATERIALS AND METHODS:** This was a cross-sectional study of full-time academic OMSs in the United States. The predictor variables were categorized as demographic (gender, medical degree, research doctorate, other advanced degree) and quantitative measures of academic productivity (total number (#) of publications, total # of citations, maximum # of citations for a single article, I-10 index – number of publications with  $\geq 10$  citations, H-index – number of papers h with  $\geq h$  citations). The outcome variable was current academic rank (instructor, assistant professor, associate professor, professor, and endowed professor). Descriptive, bivariate, and multiple regression statistics were computed to evaluate associations between the predictors and academic rank. Receiver-operator characteristic curves were computed to identify thresholds for academic promotion. A p-value  $\leq 0.05$  was considered significant.

**RESULTS:** The sample consisted of 324 academic OMSs. Thirty-eight surgeons were female, 40% had medical degrees, and 8% had research doctorates. The H-index was the most strongly correlated with academic rank ( $r = 0.64$ ,  $p < 0.001$ ). H-indexes of  $\geq 4$ ,  $\geq 8$ , and  $\geq 13$  were identified as thresholds for promotion to associate professor, professor, and endowed professor, respectively ( $p < 0.001$ ).

**CONCLUSION:** The H-index is strongly correlated with academic rank among OMS faculty. Promotions committees should consider using the H-index as an assessment of research activity when evaluating candidates for academic advancement.

## IMMEDIATE RECONSTRUCTION OF SEGMENTAL DEFECTS WITH NON-VASCULARIZED BONE GRAFTS

**AUTHORS:** Brian Alpert, DDS and George M. Kushner, DMD, MD

Segmental defects of the mandible result from a variety of causes. Ablation of both benign and malignant tumors, excision of segments of the mandible secondary to osteomyelitis and traumatic avulsion are notable etiologies. Reconstruction of these defects has been controversial with strong advocates for free flaps of any defect over 2.5 cm and others advocating delayed reconstruction with conventional non-vascularized grafts.

It was our belief that if the remaining overlying soft tissue is adequate in quality and quantity to allow a tension free closure over the graft both intra and extraorally, a non-vascularized graft is appropriate and predictable with autogenous particulate marrow

Over the past 20 years we have done immediate reconstruction of segmental defects in 19 patients who underwent resection for benign odontogenic tumors. We previously reported our results with an additional 9 segmental resections with immediate reconstruction and nerve sparing for end stage osteomyelitis.\*

19 patients were involved with defects ranging in size from 4.0 to 14 cm. Two patients had fixation of the segments with titanium mesh. In 17, reconstruction plates or locking reconstruction plates were used. In 5 patients, a neurovascular bundle sparing resection had been performed.

All patients were fundamentally healthy with adequate soft tissue in quality and quantity for 2 layer intraoral closure without tension. Grafts were harvested from the hip or tibia and were primarily particulate. Patients were followed until evidence of bone formation in the defect.

Mandibular continuity was restored in 18 of 19. In 16 patients, healing was uneventful. In one case (titanium mesh tray), the intraoral wound broke down with exfoliation of some particulate material. However, the wound granulated and epithelialized over with consolidation of the majority of the graft. One patient had multiple bouts of extraoral drainage with multiple minor debridements but ultimately healed adequately. One patient had intraoral wound dehiscence with hardware failure (screw loosening), loss of much of the graft, requiring revision of the fixation and regrafting with particulate marrow.

\*Alpert and Kushner: Management of End Stage Mandibular Osteomyelitis with Nerve Preservation and Immediate Reconstruction AACMFS Meeting, Portland 2015



## CORRELATING THE DEPTH OF INVASION WITH REGIONAL METASTATIC DISEASE TO LYMPH NODES IN THE NECK FOR ORAL SQUAMOUS CELL CARCINOMA

**AUTHORS:** Hans C. Brockhoff II DDS,MD, Roderick Y Kim DDS, Thomas Braun PhD, Joseph Helman DMD, Christos Skouteris DMD, PhD, Brent Ward DDS, MD

**INTRODUCTION:** Regional Metastatic disease to the lymph nodes remains an important clinical prognostic factor in oral squamous cell carcinoma. When considering all stages, occult nodal metastasis has been reported in up to 50% of cases.<sup>1</sup> The aim of this study was to review the experience at our institution and investigate what the critical depth of invasion would be leading to a 20% or greater risk to nodal metastasis.

**MATERIALS AND METHODS:** IRB approval was obtained per institutional protocol, and a retrospective review of our head and neck database was performed from 2009-2014. The metrics of interest included: age, gender, race, pathologic stage (via TNM), location of primary tumor, depth of invasion, size of tumor, and presence of lymph node involvement. All gathered information was statistically analyzed.

**RESULTS:** A total of 303 patients with a diagnosis of oral squamous cell carcinoma in need of a primary excision and neck dissection presented to our institution. Of these patients, 286 met our inclusion criteria. 169 (59%) were male and 117 (41%) were female with average age at the time of surgery being 63 years. Overall, 115 (40%) had at least one positive node. For a depth of invasion of 1mm or less, there were no patients with a positive node. From 1.1-2mm of depth of invasion there was 1/11 (9%) patients who had at least one positive node. At 2.1mm-3mm 5/25 (20%) patients had at least one positive node. When considering the remainder of 1mm increments of depth of invasion from 3mm to 10mm, none were less than 20% (range 27%-50%).

**CONCLUSION:** Based on our experience, it would be reasonable to consider a neck dissection for a patient who presents with greater than 2mm depth of invasion.

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## THE SUPRACLAVICULAR ARTERY ISLAND FLAP: THE NEW “WORKHORSE” IN HEAD AND NECK RECONSTRUCTION?

**AUTHOR:** Alessandro Cusano, MD, DDS, FACS

Head and neck defects in the irradiated, vessel-depleted neck continue to present significant challenges to the reconstructive surgeon. Defects tend to be large and complex, and reconstructive options are typically limited by local tissue quality and recipient vessel availability. The pedicled pectoralis major flap has earned its reputation as “the workhorse flap” in head and neck reconstruction largely because of its versatility and reliability in reconstructive salvage; and it is generally regarded as the flap of choice in such cases. Donor site morbidity, however, and an often-undesirable tissue bulk typically result in reconstructive outcomes that are less than ideal. In this article, I present a series of two patients previously treated for head and neck malignancies with both surgery (resection of the primary and cervical lymphatics) and chemoradiation, who went on to develop secondary defects as a result of radiation-induced tissue necrosis (n=1) and tumor recurrence (n=1). Both patients had previously underwent pectoralis major myocutaneous island flaps earlier in their treatment course for primary reconstruction and reconstruction of a pharyngocutaneous fistula, respectively. In both patients, reconstructive salvage was successfully achieved with a pedicled supraclavicular artery island flap. Donor site morbidity was judged to be minimal, and tissue pliability ideal for both cases. The supraclavicular artery island flap is a valuable tool in head and neck surgeon’s armamentarium, and should be considered early in the reconstructive algorithm, particularly in cases where local and free tissue options are unavailable.



## HIGHER PERIOPERATIVE FLUID ADMINISTRATION IS ASSOCIATED WITH INCREASED RATES OF COMPLICATIONS FOLLOWING HEAD AND NECK MICROVASCULAR RECONSTRUCTION WITH FIBULAR FREE FLAPS

**AUTHORS:** Kyle S. Ettinger, DDS, MD, Brandon W. Peck, MD, Matthew D. Reiland, DDS, Brett J. Bezak, DMD, Eric J. Moore, MD, Kevin Arce, DMD, MD

**PURPOSE:** To evaluate the impact of perioperative fluid administration on the rates of postoperative complications following head and neck microvascular reconstruction with fibular free flaps.

**MATERIALS AND METHODS:** Using a retrospective cohort study design, a sample of subjects undergoing head and neck microvascular reconstruction with fibular free flaps at Mayo Clinic between 2006-2014 were identified. The primary predictor variable was the total volume of perioperative fluids administered on the day of surgery. The primary outcome variable was the presence of medical and surgical complications occurring within thirty days of surgery. Basic demographic information, comorbidity indices, and intraoperative parameters were abstracted as covariates. Univariable and multivariable models were developed to assess for associations between the primary predictor variable and covariates relative to the primary outcome variable.

**RESULTS:** The study sample was composed of 154 subjects. One hundred and ten subjects (71%) experienced a medical or surgical complication within 30 days of surgery. Total perioperative fluid volume was found to be significantly associated with the presence of postoperative complications in multivariable modeling (OR=1.21; 95% CI: 1.02-1.44;  $p = 0.032$ ). An optimal cutpoint for total fluid volume to separate patients with and without postoperative complications was identified at 5500 mL through additional multivariable modeling.

**CONCLUSION:** Liberal perioperative fluid administration is associated with increased rates of medical and surgical complications following microvascular head and neck reconstruction with fibular free flaps. Fluid volumes greater than 5500 mL are associated with increased rates of complications within this patient population.

## AN OPEN LABEL STUDY OF IMMEDIATE BONE GRAFTING WITH MANDIBULAR NEUROVASCULAR BUNDLE PRESERVATION

**AUTHOR:** Robert E. Marx, DDS

As exemplified by robotic and endoscopic surgery as well as selective neck dissections, the focus today is on minimally invasive and preservative surgery. A fifty patient prospective study of immediate bone grafting with mandibular neurovascular bundle preservation was accomplished for extirpation of benign odontogenic tumors. Each resection observed 1 cm margins and required a minimum of a 6 cm continuity defect that was reconstructed using in-situ tissue engineering without the harvest of any autogenous bone. A follow-up period of four years to 8 years was required.

**RESULTS:** All patients 50/50 healed without complication and with excellent bone regeneration. No tumor recurrence was noted in the postoperative follow-up period of 4 to 8 years (mean 5.7 years). Forty seven of the fifty patients (94%) reported an equal sensation as compared to the operative side. The 3 of 50 patients (6%) who reported a difference in sensation characterized it as "slight: Two point discrimination testing noted a slight reduced sensation as compared to the un-operated side in these three patients as well as three additional patients (6/50 - 12%).

**CONCLUSIONS:** Neurovascular bundle transposition and immediate grafting using in-situ tissue engineering is a significantly reduced morbidity, time saving, and cost saving approach for the immediate reconstruction of benign odontogenic tumor defects that produces excellent implantable bone in full continuity defects the mandible without evidence of tumor recurrence.

## NANOCRYSTALLINE DIAMOND COATING ON A TEMPOROMANDIBULAR JOINT RESURFACING DEVICE: AN ANIMAL MODEL

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The temporomandibular joint is a complex joint with frequent functional demands. It is not uncommon for patients to develop derangements or degenerative changes leading to pain and dysfunction. Several animal models have been used to evaluate form and function in comparison to the human TMJ, and swine TMJs have been shown to more closely resemble human TMJs.<sup>1</sup> The purpose of our study is to evaluate the implantation and long term functional and wear characteristics of a diamond-on-diamond temporomandibular joint resurfacing device using a swine model.

Eight Yucatan (Sinclair) miniature swine were selected to undergo bilateral total temporomandibular joint (TMJ) resurfacing. A nanocrystalline diamond-coated prosthesis was placed into seven animals. Plain titanium was used in one animal as a control. All animals were placed in intermaxillary fixation prior to the procedure to maintain occlusion and post-operative imaging was utilized to evaluate placement. The animals were monitored clinically for signs of infection at the surgical site as well as for diet tolerance and weight maintenance. Care of the animals and monitoring of the health and behavior of the animals was performed by the veterinarian and surgical team. The animals were sacrificed at one year post implant placement. Cone beam CT scans were taken of each joint to help study implant positioning and integration. The prosthesis as well as the surrounding soft tissue was harvested and evaluated for wear and surrounding tissue reaction. Hardware was assessed for degree of osseointegration.

All animals had excellent occlusion after surgery, tolerated their diets well and continued weight gain over the next year. Anterior dislocation was observed in one animal immediately postoperatively but was reduced without further occurrence. Three animals developed unilateral postoperative infections requiring conservative incision and drainage. The control animal developed an infection postoperatively on one side and was found to have loose hardware requiring removal of the device. No animal had evidence of CN VII injury. Cone beam CTs of joints revealed significant heterotopic bone formation in the condylar area in all animals that appeared to laterally displace the condylar portion of the device in some cases. A loose screw from the fossa component was noted on one animal and another with a loose screw from condylar component was noted. Despite these issues, the majority of the animals had good retention of the prosthesis and relatively good articulation of the condyle and fossa. However, the diamond coating of the prosthesis did appear to have significant wear in all cases after one year on analysis.

TMJ replacement materials have required modification over time due to unfavorable outcomes. One alternative to the current implants lies in nanostructured diamond coating of titanium alloy surfaces. The swine as a model of the human TMJ has been supported due to its similar range of motion and its comparable anatomic and articular relationships.<sup>2</sup> The current goal is focused on development of a device utilizing a more conservative surgical procedure to provide low friction and no wear debris with significantly enhanced articulation.

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## TRIGGER-SITE DECOMPRESSION FOR THE TREATMENT OF MIGRAINE HEADACHES: FACT OR FICTION?

**AUTHOR:** Timothy M Osborn, DDS, MD

**INTRODUCTION:** Approximately 36 million Americans suffer from migraine headaches with a prevalence of 18% of women and 6% of men. The pathophysiology of migraine is not well understood but includes peripheral trigger site activation by nerve compression or neurogenic inflammation. The efficacy of “procedures” for treatment of migraine headaches is passionately debated with no consensus. Trigger site decompression for the treatment of migraine headaches has been shown to be effective in reducing frequency, intensity, and duration of the migraine in roughly 80% of patients.

**METHODS:** Patients who are treated with trigger-site decompression are being evaluated for demographic, headache-related therapies, headache trigger sites, and outcomes assessed. Patients who are candidates for surgery, have a full neurologic workup to rule out secondary headache disorder and provide optimal medical management. Patients are treated with botulinum neurotoxin to assess therapeutic response for chronic migraine, however favorable response is not a criterion for proceeding with surgical intervention.

**RESULTS:** This abstract is the interim work of ongoing outcomes assessment of patients. Over the past 2 years, 6 patients have undergone trigger site decompression for the treatment of migraine headaches at Boston Medical Center. All 6 patients are women diagnosed with chronic migraine headache (migraine >15days/month). The distribution of trigger sites decompressed include supraorbital, supratrochlear, zygomaticotemporal, zygomaticofacial, auriculotemporal, and greater occipital. Of the 6, 4 have had favorable outcome including 50% reduction in frequency (days), intensity (VAS), and duration of headaches (hours). The 2 patients with <50% reduction in symptoms have ongoing issues with temporomandibular dysfunction, and neither of them responded favorably to injection of botulinum neurotoxin prior to the procedure.

**CONCLUSIONS:** Trigger-site decompression for treatment of chronic migraine headaches is an effective procedure for treatment of this debilitating condition, and those who respond best to the surgery have favorable response to botulinum neurotoxin for trigger-site deactivation.

## OUTCOMES AND IMPLEMENTATION OF A HEAD AND NECK CLINICAL PATHWAY

**AUTHORS:** Rui Fernandes, MD, DMD, Phillip Pirgousis, MD, DDS, Jacob Yetzer, MD, DDS

**BACKGROUND:** American healthcare has come under intense scrutiny with a focus on improving value in both the private and public sectors. Surgeons nationwide have been tasked with providing better value-based care, which calls for improved outcomes and/or reduction of cost. One manner of achieving better value has been seen in establishing clinical pathways for specific patient pools.

**OBJECTIVE:** To determine the effect on inpatient outcomes in a head and neck surgical population after the implementation of a clinical pathway.

**METHODS:** Retrospective chart review from January 2014 through December 2014 for all patients undergoing head and neck surgery with microvascular reconstruction. Outcomes were compared between two six-month periods and two operative surgeons. During the initial timeframe, no clinical pathway was utilized (groups A and C), while during the second timeframe, one of the two surgeons' practices implemented the pathway (group B) vs. the group without (group D). Outcomes measures compared include length-of-stay, return to operating room, and transfer to ICU level of care.

**RESULTS:** A total of 66 charts were reviewed. The length-of-stay decreased dramatically in the group with the protocol implemented (group B) which had 9/15 (60%) discharged in less than one week as compared to group A at 3/17 (17.6%). The non-pathway group had lesser improvement with 3/20(20%) in group D discharged in less than one week in the second six months as compared to group C with 1/14(7.1%). Transfer to ICU level care was 0% and 20% in groups A and B respectively and 21.4% and 35% in groups C and D. Groups A and B had 0% rate return to OR and the rates for groups C and D were 14.3% and 10%.

**CONCLUSIONS:** Our data suggest that implementation of a well-defined clinical pathway may decrease overall length of hospital stay while maintaining quality outcomes thus delivering healthcare value.

## COMPARISON OF ACCUPLAN ORTHOGNATHIC AND ARTICULATED MODEL PLANNING FOR BIMAXILLARY ORTHOGNATHIC SURGERY

**AUTHORS:** Ron Caloss DDS, MD, Jayanthi Parthasarathy BDS, MS, PhD, Yuanyuan Duan BDS, PhD, Wei Wang PhD, Nancy Hairston

**PURPOSE:** The purpose of this study was to compare the 3D dental movements using MedCAD's AccuPlan Orthognathic 3D virtual planning software to movements obtained from articulated model surgery for bimaxillary surgery

**MATERIALS AND METHODS:** We retrospectively obtained surgical records of 10 patients who had undergone bimaxillary orthognathic surgery at our institution. A new centric relation (CR) record, and intermediate and final splints were made on the articulated models. The 3D changes in molar, canine and incisor positions were recorded using an Erickson Model Block. Records required for virtual surgery planning were then sent to MedCAD. Their engineer imported the cone-beam computed tomography data and digital stone models into interactive software to create a composite 3D model and perform virtual osteotomies. 3D models were then imported into AccuPlan Orthognathic for virtual surgical planning. The maxillary and mandibular movements were reverse-engineered utilizing the CR record and intermediate and final splints provided from articulated model surgery. The 3D changes in molar, canine and incisor positions for the virtual model surgery were recorded for comparison with the articulated model surgery.

**RESULTS:** The maximum absolute difference between articulated model and virtual model movements in the anteroposterior, vertical and transverse dimension for both arches was 1.6 mm, 1.2 mm, and 1.0 mm respectively. The mean absolute difference between the two methods was between 0.2 and 0.5 mm in all three dimensions for both arches. The 95% confidence interval of the differences was found to be statistically equivalent with a 0 to 1 mm preset zone of equivalence.

**CONCLUSION:** The 3D dental movements obtained with AccuPlan and articulated model surgery were equivalent. This suggests dimensional accuracy with data transfer and processing using MedCAD's workflow and AccuPlan Orthognathic. Thus we find this a reliable virtual planning system.



## RECONSTRUCTION OF THE ERODED SOFT PALATE SECONDARY TO INTRANASAL NARCOTIC ABUSE

**AUTHORS:** William Curtis DMD, MD; Paul Kloostra DDS, MD; Michael S. Jaskolka DDS, MD, FACS

**INTRODUCTION:** Opioids are becoming more common in the treatment of chronic nonmalignant pain. With increased availability of opioids for chronic pain we may expect an increased misuse of these as analgesics as well. The authors describe the case report of a young woman with chronic back pain and intranasal abuse of prescribed hydrocodone/acetaminophen who was diagnosed after presenting for hypernasal speech and foreign body in the nose. This case report highlights the need for vigilance on the part of the physician for any aberrant drug-related behaviors. Any unusual symptoms or signs such as hypernasal speech, chronic nasal infection, or unexplained foreign body sensation in the nose should be thoroughly investigated.

**BACKGROUND/PURPOSE:** The effect of cocaine on maxillofacial structures has been well characterized in the literature, but there have been few reports on the impact of intranasal inhalation of crushed narcotic pills. Although the specific pathophysiology has not been delineated, the mechanism of necrosis appears to be distinct from that of cocaine as there is less damage to the intranasal structures, sparing of the hard palate and total erosion of the soft palate.

We report on a series of 3 patients that presented due to symptoms of severe velopharyngeal insufficiency with complete erosion of the soft palate as a result of inhalational narcotic abuse. Our surgical approach will be detailed, and employs a combination of maneuvers employed for traditional management of the cleft palate.

**METHODS:** A retrospective chart review between 2012 and 2014 was completed. CBCT was obtained to evaluate the maxillofacial structures with specific attention given to the palate, sinuses and intra-nasal anatomy. Nasopharyngoscopy was used to characterize the soft tissue of the nasopharynx and rule out the presence of foreign body remnants, active ulceration or infection. Speech samples were recorded and compared pre and post-operatively using a standardized format.

**RESULTS:** Surgery was completed without intra-operative complication or significant blood loss. The average length of hospitalization was < 2 days. 1 patient presented with partial wound breakdown. No other post-operative complications were recorded. Symptoms of nasal regurgitation were eliminated in all patients. Speech was significantly improved with all patients reporting normalization of intelligibility.

**CONCLUSION:** Abuse of intranasal inhalation of crushed narcotics results in a unique pattern of soft palate destruction resulting in velopharyngeal insufficiency. The application and minor modification of techniques traditionally employed for repair of the cleft palate can be applied for successful reconstruction of the soft plate in this circumstance. Significant improvement in function can be obtained to aid in the rehabilitation of this patient population.

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**Intranasal abuse of prescription hydrocodone/acetaminophen results in oronasal fistula: a case report.**

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## TOOTH MASS PROBLEMS IN PATIENTS REQUIRING MANDIBULAR ADVANCEMENT SURGERY

**AUTHORS:** Andrew Hanna, DDS, MD, Edward Ellis, DDS

**INTRODUCTION:** Numerous studies have shown that tooth size is an important key to an ideal occlusion. Bolton described a constant ratio between the widths of the upper and lower teeth that must be present to achieve an optimal occlusion. More importantly, he also discovered that a satisfactory Class I canine occlusion was only possible if a specific proportion in widths was present between the upper and lower anterior teeth.

**OBJECTIVES:** **A)** To determine the incidence of Bolton's discrepancies in patients with Class II malocclusion scheduled for mandibular advancement surgery. **B)** To demonstrate a method of orthodontic preparation that allows the establishment of a Class I canine relationship during surgery.

**STUDY DESIGN (MATERIALS AND METHODS):** This study included 126 (40 males and 86 females) Class II patients who had at least a mandibular advancement as part of their surgical treatment. The mesiodistal widths of the six anterior maxillary and mandibular teeth were measured on preoperative models of those patients using a Helios manual caliper (accurate to 0.01 mm). The measurements were then used to compute the anterior Bolton's ratio.

**RESULTS:** Error of the method was performed by re-measuring the casts of 5 randomly selected patients from the original sample. The error of measurement ranged from 0.05 mm to 0.21 mm, which is considered to be insignificant. Systematic error was also measured using student paired t-test following Bonferroni correction and was found to be insignificant. 68 patients out of 126 (53.9 %) were found to have an anterior Bolton's discrepancy.

**CONCLUSION:** Bolton's discrepancies exist in majority of patients with Angle and Skeletal Class II malocclusions. Bolton's discrepancies should be taken into consideration when treatment planning for pre-surgical orthodontics. It would be reasonable for orthodontists to routinely create a space distal to the maxillary lateral incisors to allow the establishment of a solid Class I canine occlusion during surgery without creating an end-to-end incisor occlusion during mandibular advancement surgery.

## ADJUVANT ANTIANGIOGENIC THERAPY FOR AGGRESSIVE GIANT CELL LESIONS OF THE JAWS: UPDATE ON THE MASSACHUSETTS GENERAL HOSPITAL PROTOCOL AFTER 18 YEARS

**AUTHORS:** W.H. Schreuder, Z.S. Peacock, D. Ebb, S.K. Chuang, L.B. Kaban

Giant cell lesions (GCLs) are primary mesenchymal tumors that affect the maxillofacial and axial/appendicular skeletons. Based on clinical and radiographic criteria they are classified as aggressive or non-aggressive tumors. Aggressive lesions are large, rapidly growing, destroy bone, displace teeth and have a high recurrence rate after curettage alone. Standard of care has been en bloc resection. In 1996, our group began using a protocol consisting of enucleation of the tumor, preserving vital structures (teeth and nerves), in combination with adjuvant interferon alpha-2a chemotherapy<sup>1</sup>. This was based on the hypothesis that maxillofacial GCLs are proliferative vascular lesions and angiogenesis dependent. The purpose of this study was to evaluate the long-term results of this standardized treatment regimen, in a homogenous cohort of patients with aggressive GCLs of the maxillofacial skeleton, after 18 years.

This was a retrospective cohort study of all patients who underwent enucleation and adjuvant interferon alpha-2a for GCLs at Massachusetts General Hospital. Subjects were included if they had a histologically confirmed GCL that was classified as aggressive by clinical and radiographic criteria,<sup>2</sup> completed the protocol, and had complete records. Subjects with systemic diseases associated with GCLs (e.g. Cherubism, Noonan-like multiple giant cell syndrome) were excluded. The primary outcome variable was the percentage of subjects with no new or recurrent tumor growth at the latest followup, at least 3 years after finishing treatment. A secondary outcome variable was the incidence and severity of side effects of adjuvant therapy. The effect of the following predictor variables, on the duration of disease free survival after completion of treatment, was assessed: age, location (mandible/maxilla), duration of treatment, amount of bone fill at the end of interferon treatment, need for additional treatment.

Descriptive statistics were computed to describe patient, tumor and response characteristics. Kaplan-Meier survival was calculated for progression free survival analysis. The Cox proportional hazards regression analysis was used to assess the relationship of the predictor variables on disease free survival. Statistical significance was set at p-value  $\leq 0.05$ .

Forty-four subjects (28 females) out of 47 undergoing the protocol were included in this study. Mean age of the subjects was  $18.2 \pm 12.7$  years. The majority of patients were less than 16 years of age. Lesions occurred in the maxilla (23%) and mandible (77%). Interferon alpha-2a was administered for an average of  $8.0 \pm 2.6$  months. The mean follow up after the last interferon was  $5.1 \pm 3.4$  years. Six patients developed a recurrence, leading to a failure rate of 13.6%. Recurrences were successfully managed by an additional course of interferon or by bisphosphonate therapy. None of the predictor variables had a significant effect on the recurrence rate. The majority of patients had at least 1 side effect/complication of interferon therapy, managed by adjusting the dose.

The results of this long-term outcome study indicate that enucleation and adjuvant interferon alpha-2a is an effective protocol for managing aggressive maxillofacial GCLs while sparing vital structures such as teeth and nerves. Patients who experienced side effects during treatment were able to complete the protocol and had no long-term side effects.

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## **AUTOGENOUS VS ALLOPLASTIC TMJ RECONSTRUCTION IN PATIENTS WITH AUTOIMMUNE DISEASE**

**AUTHOR:** Pushkar Mehra, BDS, DMD

**PURPOSE:** To assess clinical outcomes following autogenous and alloplastic temporomandibular joint (TMJ) reconstruction in patients with autoimmune/connective tissue diseases.

**PATIENTS AND METHODS:** The treatment records of patients with medically-confirmed autoimmune/connective tissue disease-related arthritis of the TMJ'Ss who underwent surgical management at one center from 2000-2008 were retrospectively analyzed. The patients were divided into two groups based on type of TMJ reconstruction performed: Group 1 (autogenous) and, Group 2 (Alloplastic). Clinical and radiographic examination was performed at presurgery (T1), and longest follow-up (T2)/(LFU) intervals.

**RESULTS:** 30 patients were included in the study (9 patients in group 1 and 21 in group 2). Patients with alloplastic reconstruction fared better at LFU when compared with patients undergoing autogenous reconstruction relative to improvement in headaches, pain and jaw function after surgery. Patient satisfaction was also higher in Group 2. Although all patients were on systemic immunosuppressive medications and these were continued during the perioperative period, no infections at surgical sites were encountered in any patient.

**CONCLUSIONS:** Custom-made total joint prostheses provide better clinical outcomes than autogenous tissues for TMJ reconstruction in this sub-group of patients. They eliminate donor site morbidity, reduce operating room time, and permit large mandibular advancements to be simultaneously performed with excellent long-term stability.

## CLEFT CHARACTERISTICS AND TREATMENT OUTCOMES IN HEMIFACIAL MICROSOMIA COMPARED TO NON-SYNDROMIC CLEFT LIP/PALATE

**AUTHORS:** Kelley M. Dentino, DMD, Avalon Valstar, Bonnie L. Padwa, DMD, MD

**OBJECTIVE:** Describe clinical characteristics and treatment outcomes for patients with Hemifacial Microsomia (HFM) and cleft lip and/or palate (CL/P), and compare them to a historic cohort of patients with non-syndromic CL/P.

**DESIGN:** Retrospective medical records review.

**SETTING:** Tertiary care center.

**PATIENTS:** All patients with HFM and CL/P treated at Boston Children's Hospital between 1962 and 2012. There were 26 patients, 13 males and 13 females, whose mean age at the time of analysis was  $22.7 \pm 14.9$  years (range: 1-52).

**MAIN OUTCOME MEASURES:** Cleft type and side, number and type of operative procedures, surgical outcomes, midfacial growth, and speech were documented and compared to data from a historic cohort of patients with non-syndromic CL/P treated at the same tertiary care center.

**RESULTS:** There were 26 HFM patients who had CL±P: 3 (12%) with CL only, 2 (8%) with CLA and intact secondary palate, and 21 (81%) with CLP; unilateral (n=15) and bilateral (n=6). Four patients (20%) had palatal fistula after palatoplasty. Twelve of 22 patients age 5 or older (55%) had midfacial retrusion and 2 (10%) required a pharyngeal flap for velopharyngeal insufficiency (VPI).

Fisher's exact test demonstrated a higher frequency of complete labial clefting ( $p=0.004$ ) and CLP ( $p=0.009$ ) in HFM compared to non-syndromic CL±P, as well as higher rates of midfacial retrusion ( $p=0.0009$ ) and post-operative palatal fistula ( $p=0.03$ ). There was no significant difference in the prevalence of VPI as measured by the need for pharyngeal flap, however, when a pharyngeal flap was performed, it was less successful ( $p=0.038$ ) in patients with HFM.

**CONCLUSIONS:** Patients with HFM and CL±P have more severe forms of clefting and higher rates of midfacial retrusion and palatal fistula compared to non-syndromic CL±P patients. A pharyngeal flap is less likely to resolve VPI in patients with HFM.



## EARLY VERSUS LATE IMPROVEMENT IN CEPHALIC INDEX AFTER ENDOSCOPIC ASSISTED SAGITTAL CRANIOSYNOSTOSIS REPAIR WITH POSTOPERATIVE CRANIAL MOLDING ORTHOSIS

**AUTHORS:** Dr. Aaron Wallender, DDS, MD, Dr. Barry Steinberg, PhD, DDS, MD, FACS, Dr. Nathan Ranalli, MD

**INTRODUCTION:** Minimally invasive endoscopic techniques for the treatment of sagittal craniosynostosis have been shown to achieve excellent long-term outcomes. The objective assessment of calvarial reconfiguration centers on serial measurement of cephalic index. Limited objective information is present in the literature about changes in the cephalic index over the course of postoperative helmet therapy. Our primary objective in this retrospective case series is to quantify this change in cephalic index, with secondary objectives intending to show that the rate of cephalic normalization decreases further from surgery irrespective of other variables.

**METHODS:** We analyzed data from 7 cases of primary sagittal craniosynostosis treated with endoscopic wide vertex craniectomy and biparietal wedge osteotomies performed at our institution between 2012-2013 in infants aged 3-6 months. Each patient's cephalic index was quantified using pre- and postoperative STAR scanning over the course of up to one year. We compared changes in cephalic index one week after surgery to the rate of change further from the operation using t-test analysis.

**RESULTS:** Although patient compliance with STAR Scan was not consistent, (range of 3- 6 STAR Scans per patient) the immediate postoperative difference from surgery to first (1 week) STAR Scan was significant. In comparison to the total change, 33% of cephalic index normalization occurred during this one week period versus the rest of the year (average change of 0.0436). In fact, 4 months after surgery little to no change in cephalic index occurred. At the conclusion of the study, all patients noted normalization of cephalic index (range of 0.76-0.81).

**Conclusions:** The majority of improvement in cephalic index occurs most rapidly after initial surgical intervention, consistent with observations at other institutions. This change is noticeably visible on the operating room table, and quantifiable at initial STAR scan. Change occurs throughout helmet therapy, but at a slower rate of change further from surgical intervention with plateau at 4 months. All patients achieved normalization of cephalic index.

We intend to investigate the factors that may account for the decreasing rate of change during the treatment period, including socioeconomic barriers, parental compliance with the helmeting regimen, and recognized patterns of physiological head growth.

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## **HYPOTENSIVE ANESTHESIA IS ASSOCIATED WITH SHORTENED LENGTH OF HOSPITAL STAY FOLLOWING ORTHOGNATHIC SURGERY**

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**PURPOSE:** The purpose of this study was to evaluate the impact of induced hypotensive anesthesia on the length of hospital (LOS) stay for patients undergoing maxillary LeFort I orthognathic surgery in isolation or as a component of a multi-jaw procedure.

**MATERIALS AND METHODS:** A retrospective cohort study design was implemented and subjects undergoing LeFort I orthognathic surgery at Mayo Clinic from 2010-2014 were identified. The primary predictor variable was the presence of induced hypotensive anesthesia during orthognathic surgery. Hypotensive anesthesia was defined as  $\geq 10$  consecutive minutes of a mean arterial pressure (MAP) of  $\leq 60$  mmHg documented within the anesthetic record. The primary outcome variable was LOS in hours following completion of orthognathic surgery. The secondary outcome variable was the duration of surgery in hours documented in the anesthetic record. Multiple covariates also abstracted included patient age, patient gender, and American Society of Anesthesiologists (ASA) score, complexity of surgical procedure, and volume of intraoperative fluids administered during surgery.

**RESULTS:** One hundred and seventeen patients were identified undergoing LeFort I orthognathic surgery in isolation or in combination with mandibular surgery. Induced hypotensive anesthesia was found to be significantly associated with shortened LOS (OR=0.33; 95% CI: 0.12-0.88;  $p=0.026$ ) relative to patients with normotensive regimens. This association between hypotensive anesthesia and LOS also remained statistically significant in subgroup analysis of forty-seven patients where isolated LeFort I surgery was performed (OR=0.13; 95% CI: 0.06-0.62;  $p=0.010$ ). Induced hypotensive anesthesia was not found to be significantly associated with shorter duration of surgery.

**CONCLUSION:** Induced hypotensive anesthesia represents a potential way to minimize postoperative LOS for patients undergoing routine maxillary orthognathic surgery alone or in combination with mandibular procedures. Hypotensive anesthesia does not appear to be effective in minimizing the duration of surgery within this same patient population.

## MANAGEMENT OF MANDIBULAR INJURIES WITH CONDYLAR INTRUSION INTO MIDDLE CRANIAL FOSSA

**AUTHORS:** Varun Arya, DMD: Radhika Chigurupati, DMD, MS

**PURPOSE:** Traumatic injuries of the mandible resulting in intrusion of the mandibular condyle into the middle cranial fossa are rare events. The objective of this study was to systematically review the literature on condylar intrusion injuries, conduct a meta-analysis of the data and present a treatment algorithm.

**METHODS:** Case reports, case series and review articles on mandibular injuries with intrusion of the condyle into the middle cranial fossa were obtained from the English literature. For the meta-analysis, we included only those articles that had adequate data on demographic characteristics such as age and gender, the mechanism or etiology of injury, the time lag between injury and diagnosis, and the treatment performed.

**RESULTS:** We identified 62 published articles on condylar intrusion injuries into middle cranial fossa in the literature. Of these, 48 articles were in English language and 14 articles in other languages that were excluded from this review. We had a total of 56 patients; 53 were described in the literature and, 3 patients were treated by the senior author. Only 51 of these patients qualified for the meta-analysis of data. The analysis of the data revealed that motor vehicular accidents (49%) followed by bicycle accidents were the most causes of these injuries. Younger females had a higher predilection than males. As expected, patients with a greater time lag from injury to diagnosis required open treatment approaches for reduction of condyle. Closed reduction was feasible in the majority of patients with condylar intrusion diagnosed within the first 2 weeks of injury.

**CONCLUSIONS:** The results of the meta-analysis revealed that the age of the patient and time lag from injury to diagnosis were the two significant factors that influenced surgical treatment decisions.

## EXTRACORPOREAL REDUCTION AND FIXATION OF MANDIBULAR CONDYLAR PROCESS FRACTURES: A RETROSPECTIVE AGE, GENDER, AND DISLOCATION MATCHED COHORT OUTCOME ANALYSES

**AUTHORS:** Joseph E. Cillo, Jr., DMD, MPH, PhD, David J. Dattilo, DDS

**PURPOSE:** The purpose of this study was to conduct an early outcome analysis between extracorporeal reduction and fixation, open reduction and internal fixation, and closed treatment of severely displaced and dislocated mandibular condylar process fractures for fracture reduction and chin deviation on opening.

**SUBJECTS AND METHODS:** This was an age-, gender-, and dislocation-matched retrospective cohort early outcomes analyses of unilateral mandibular condylar process fractures, with or without rigidly fixated concomitant mandibular fractures, treated with either extracorporeal reduction or fixation (ECRF), open reduction and internal fixation (ORIF), or closed treatment by maxillomandibular fixation (MMF). Evaluation of 1 week post-operative fracture reduction and chin deviation on opening was conducted through chart, radiographic, and photographic review. Fracture reduction was classified as excellent, good, fair, or poor and chin deviation on opening was categorized as yes or no. The Fisher's exact test for categorical data and the one-way ANOVA for continuous data were utilized to determine statistical significance between groups set at the  $p < 0.05$  level.

**RESULTS:** Seven subjects were identified in each group matched by age-, gender-, and level of dislocation. There were no statistically significant difference between groups for age ( $p = 0.4$ ), gender ( $p = 0.9$ ), amount of dislocation ( $p = 0.9$ ). There were statistically significant differences between groups for post-operative reduction (Excellent/Good Reduction - ECRF (100%), ORIF (86%), CT (0%),  $p = 0.0018$ ) and chin deviation on opening (Yes - ECRF (0%), ORIF (0%), CT (100%),  $p = 0.0002$ ).

**CONCLUSION:** ECRF may be a viable option to produce excellent post-operative reduction and without chin deviation on opening for severely displaced and dislocated mandibular condylar process fractures that are either not amenable to closed treatment or accessible with traditional open reduction and internal fixation methods.

## PERSPECTIVES OF ADVANCED COMPUTER-ASSISTED PROCEDURES IN CRANIOMAXILLOFACIAL SURGERY

**AUTHOR:** Nils Gellrich, MD, DMD

Diagnosis-making and therapeutic decisions in complex craniofacial deformities are mainly based on analysing VOXEL-based datasets. Within this field there has been significant technology advancement that nowadays allows to interactively analyse, plan and simulate 3D-datasets of different modalities (MRI, CT, cone beam-CT).

The treatment advances include even complex backwards planning from prosthodontic solutions, preoperative manufacturing of patient-specific implants, functionalization of implants with trajectory-based intraoperative navigation position control, image fusion with pre-op virtual models. Within this workflow even 3D-surface scans can be implemented to contribute in terms of colour and texture to the other DICOM-based dataset imaging modalities.

This lecture demonstrates and shows the sound digitally based workflow with patients suffering from acquired or congenital deformities after trauma, tumour or congenital-disorders-associated deformities. The modern interdisciplinary craniofacial surgery team has to face that this type of workflow is a huge chance to improve interdisciplinary interface and knowledge exchange and allows for helping quality control at all surgical steps through the whole treatment.

A prerequisite for establishing such a workflow is a potent imaging analysing platform that allows for integrating the above-mentioned ideas. Eighteen years of experience of improving these platforms and the set-up of a digital workflow are presented in this presentation. Multiple indications and clinical cases for the implementation of virtual models in Craniomaxillofacial Reconstruction are discussed.

## DEVELOPMENT AND CURRENT STATUS OF ADVANCED COMPUTER ASSISTED PROCEDURES IN CRANIOMAXILLOFACIAL SURGERY

**AUTHOR:** Rainier Schmelzeisen, MD, DDS, PhD

Computer assisted planning procedures change current craniomaxillofacial surgery procedures significantly. In the treatment workflow of digital computer assisted planning, surgery, intraoperative imaging with data fusion and postoperative control, surgery although being extremely important and still experience driven today, is only a part of the complex treatment flow.

In minor implant or augmentative surgery backwards planning allows for a safer approach with precise and predictable results. Today many of these backwards planning steps can be done virtually by intra- and extra-oral-scanning followed by data-fusion with cone-beam-CT-scans. These data then can be used for virtual bone-argumentations and implant positioning including 3D-printing of drill guides. In complex cases, the surgical results can be visualized by intraoperative cone-beam imaging.

In more extensive procedures for example in the midface and skull base the digital environment becomes a mandatory prerequisite and obligatory part of the surgery itself. The dimension of surgery can be estimated, approaches can be planned, regions of interest as well as danger zones can be determined. Virtually, reconstruction techniques and different materials can be considered with high anatomic precision and in 3D preoperatively. Again, image fusion, minimal invasive endoscopic procedures and intraoperative imaging as a quality control reduce the total number of necessary reconstructive procedures and increase safety in a challenging surgical environment.