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DEVELOPMENT OF THREE-DIMENSIONAL LANDMARKS FOR THE CRANIAL BASE FOR GEOMETRIC MORPHOMETRIC ANALYSIS

Authors: Denise K. Liberton, Payal Verma, Anthony Contratto, Janice S. Lee

Presenter: *Janice S. Lee, DDS, MD, MS*

Objectives: The cranial base is developmentally integrated with craniofacial growth. Three-dimensional (3D) imaging allows for landmark-based geometric morphometrics and may reveal coordinated shape changes between groups of landmarks. 3D cephalometric analysis has been developed, however, there are limited landmarks on the cranial base. The aim of this study is to develop and examine the reliability of 3D landmarks on the skull, particularly on the cranial base.

Methods: We developed 66 landmarks on the skull (43 face/mandible, 23 cranial base). Landmarks were placed on de-identified CBCT scans of 10 patients (Anatomage Invivo 5.4) by three observers based on standardized features in multi-planar views. Three landmarking trials were performed. Inter- and intra-rater reliability was assessed through measures of variance for landmarks in the X, Y, and Z planes and through multivariate analysis.

Results: For 66 landmarks with three coordinates (X, Y, and Z), we calculated the error associated with landmark placement for 198 coordinates. Of these, 122 coordinates (61.6%) had an average error < 1 mm; 68 coordinates (34.4%) had errors between 1-2 mm; 8 coordinates (4.0%) had errors >2 mm. The largest errors were associated with the X coordinates of supraorbitale and porion, the Y coordinate of antegonion, and the Z coordinates of jugale and protuberance menti. The error was highest in landmarks on the mandible (mean 1.11 mm), and lowest on the teeth and face (mean 0.93 mm). Landmarks on the cranial base had an average error of 0.94 mm.

Conclusions: We developed new cranial base landmarks and demonstrate the utility of 3D landmarking for quantification of cranial morphology from CBCT. The majority had small inter-rater errors and only 4% had high inter-rater errors. These landmarks may be used for studies to determine the integration or modularity of the development of the entire craniofacial complex.

VARIATION IN CRANIAL MORPHOLOGY IN PATIENTS WITH NON-SYNDROMIC CLEFT LIP AND PALATE VERSUS DENTOFACIAL SKELETAL DEFORMITY

Authors: Payal Verma, Denise K Liberton, Snehlata Oberoi, Bonnie Padwa, Janice S. Lee

Presenter: Janice S. Lee, DDS, MD, MS

Background: Differences in craniofacial shape may be detected in the cranial base before expression in the mandible and midface. We performed a morphometric analysis using a 3D Cartesian coordinate system to study the differences in the morphology of the craniofacial skeletal complex in patients with non-syndromic cleft lip and palate (NSCLP) compared to those with isolated dentofacial deformities (IDD).

Method: Retrospective analysis was performed on pre-operative cone-beam CT images of patients with NSCLP who required secondary orthognathic midface advancement and patients with similar dentofacial deformities but no CLP. The images were analyzed and 3D models were constructed using Anatomage InVivo 5.4 (San Jose, CA). 25 landmarks of the craniofacial complex and 19 new cranial base landmarks were identified and measured using R statistical software. Student's t-tests and multivariate principal component analysis (PCA) compared the morphological differences.

Results: 22 patients (11 NSCLP; 11 IDD) were included. Median age of patients with NSCLP and IDD were 16(9-28) and 17(15-37) years, respectively, with comparable gender and ethnicity. Distances from condylar point to anterior cranial fossa, foramen ovale to anterior cranial fossa, glenoid fossa to anterior cranial fossa bilaterally, sella to clinoid process were significantly shorter in the NSCLP cohort ($p < 0.05$). Permutation testing by PCA demonstrated significant differences in the morphology of the craniofacial complex between the two cohorts.

Conclusions: 3D morphometrics analysis demonstrates craniofacial skeletal morphological variation between 2 cohorts. Specifically, the anterior and middle cranial fossa and sphenoid bone were hypoplastic antero-posteriorly in the NSCLP cohort compared to the IDD cohort. Further analysis will examine the predictive value of the 3D imaging for those who require or do not require orthognathic treatment based on the alterations of the cranial base and impact on facial growth.

SAGITTAL CRANIOSYNOSTOSIS WITH OVERLYING CALCIFIED CEPHALOHEMATOMA IN A NEWBORN

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Presenter: Carlo Guevara, MD, DDS

Abstract: This is a case report of an otherwise healthy 3-month-old male who presented to the University of Florida Jacksonville Craniofacial Clinic with an abnormal dolichocephalic head shape and a calcified cephalohematoma on the vertex of the skull. The patient was the product of a full-term, uncomplicated birth with vaginal delivery. Although the delivery did not involve vacuum-assistance or unusual trauma, a soft boggy subgaleal swelling was noticed at the vertex of the skull immediately following birth. Over the next 3 months, the swelling became progressively defined. On clinical evaluation, the patient had a prominent firm mass on the vertex, as well as the accompanying stigmata of sagittal suture synostosis – frontal bossing, biparietal narrowing, and occipital prominence. Further evaluation was completed by plain film imaging and computed tomography. Imaging findings demonstrated a large 7cm calcified cephalohematoma with synostosis of the underlying sagittal suture. Due to the size of the calcified hematoma, as well as the dolichocephaly resultant from the synostotic suture, surgical intervention was recommended. Excision of the calcified hematoma with a sagittal strip craniectomy was performed without issue. The infant then began post-operative helmeting therapy per our craniofacial team protocol. Only a few case reports exist in the literature describing the occurrence of a calcified subperiosteal cephalohematoma and accompanying sagittal suture synostosis. Multiple differing theories exist regarding the causal relationship of the 2 phenomena, as well as the preferred method of surgical management.

Figure 1: Lateral 3D computed tomography demonstrating calcified cephalohematoma and dolichocephaly



Figure 2: Frontal 3D computed tomography demonstrating calcified cephalohematoma



Figure 3: Axial 3D computed tomography demonstrating sagittal suture synostosis and calcified cephalohematoma



Figure 4: Frontal CT scan demonstrating cephalohematoma

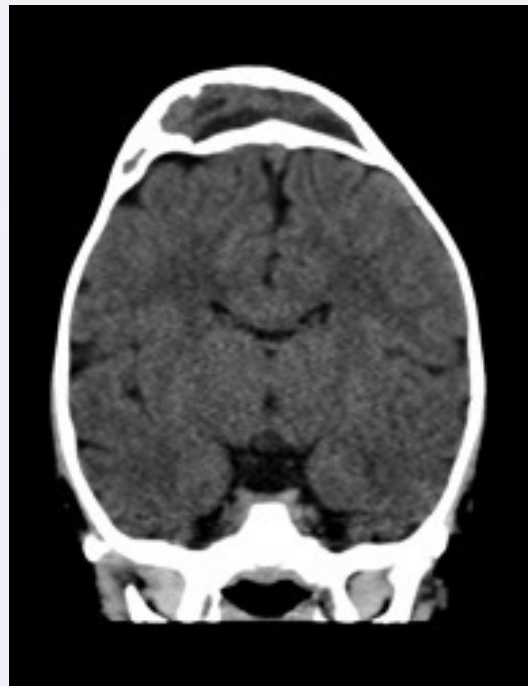


Figure 5: Surgical Specimen of divided calcified cephalohematoma



IS THERE A DIFFERENCE IN ORBITAL VOLUME BETWEEN AFFECTED AND UNAFFECTED SIDES IN PATIENTS WITH UNILATERAL CRANIOFACIAL MICROSOMIA

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Presenter: Bonnie L. Padwa, DMD, MD

Purpose: Craniofacial microsomia (CFM) is the second most common congenital craniofacial disorder characterized by involvement of the structures of the first and second pharyngeal arches. The orbit can be affected and there is a wide variability in phenotypic presentation. The purpose of this study was to measure and compare the orbital volume on the affected and unaffected sides in patients with unilateral CFM.

Patients and Methods: The authors implemented a retrospective radiographic study of patients with unilateral CFM who had a computed tomographic scan (CT) between 1990 and 2015. Subjects who had procedures involving the orbit prior to the date of imaging were excluded. The primary predictor variable was the subject side (affected vs. unaffected). The primary outcome variable was orbital volume. Manual segmentation of the orbit was performed on CT scans using Mimics software. Wilcoxon signed rank test was used to compare affected and unaffected side measurements within subjects.

Results: The sample included 39 patients (23 males and 16 females). Orbital volume was measured bilaterally on CT images obtained at a mean age of 10.75 ± 6.25 years. Orbital volume was significantly smaller on the affected side when compared to the unaffected side ($p= 0.001$).

Conclusions: The results of this study demonstrate that orbital volume is significantly smaller on the affected side in patients with unilateral CFM.

FREQUENCY AND MORBIDITY OF TEMPOROMANDIBULAR JOINT INVOLVEMENT IN ADULT PATIENTS WITH A HISTORY OF JUVENILE IDIOPATHIC ARTHRITIS

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Presenter: Cory M Resnick, DMD, MD

Purpose: The majority of patients with juvenile idiopathic arthritis (JIA) have temporomandibular joint (TMJ) involvement, but little is known about the natural history of TMJ disease as these children enter adulthood. The purpose of this study is to evaluate adults with a history of JIA to document the frequency and severity of TMJ abnormalities and morbidity. We hypothesize that a majority have persistent TMJ disease as adults.

Methods: This is a cross-sectional study including adults (>19 years-of-age) with JIA who were managed at Boston Children's Hospital (BCH) as children and at Brigham and Women's Hospital (BWH) as adults. History of a TMJ problem was not considered in enrollment. Subjects completed a questionnaire, physical examination and maxillofacial cone beam computed tomography scan (CBCT). Additional data were obtained from medical records. Associations between TMJ abnormalities on CBCT and arthritis history, TMJ pain and function, facial asymmetry, malocclusion and cephalometric analysis were examined.

Results: Of 129 eligible patients contacted, 21 subjects (42 TMJs) were enrolled. The mean age was 26.0 ± 6.1 years and mean duration of care for JIA at BCH/BWH was 13.7 ± 6.5 years. TMJ pain was present in 62% (n=13) of patients; 43% (n=9) had a TMJ functional limitation and 76% (n=16) had a lower facial asymmetry. Abnormalities were found in the TMJs on 55% of CBCTs, with 79% demonstrating bilateral deformities. There was at least one cephalometric measurement of mandibular size or position that was more than one standard deviation beyond normal in 81% (n=17) of subjects. Only 4 subjects (19%) had previously been evaluated for a TMJ problem.

Conclusion: TMJ abnormalities and related morbidity are common in adult patients with a history of JIA. Therefore, an early screening protocol for TMJ involvement in children with a new diagnosis of JIA would be beneficial and long-term follow-up into adulthood should be routine.

CONTRAST ENHANCED MRI COMPARED TO DIRECT JOINT VISUALIZATION AT ARTHROSCOPY IN PEDIATRIC PATIENTS WITH SUSPECTED TEMPOROMANDIBULAR JOINT SYNOVITIS

Authors: Aronovich S and Smith E

Presenter: Sharon Aronovich, DMD

Purpose: The temporomandibular joint (TMJ) is commonly affected in the pediatric patients with inflammatory arthropathy, such as juvenile idiopathic arthritis. Contrast enhanced magnetic resonance imaging (MRI) is frequently used to evaluate TMJ involvement in these patients. The purpose of this study is to compare MRI findings to direct visualization of the joint space at TMJ arthroscopy.

Methods: IRB approval was obtained for this retrospective study. Pediatric patients that underwent TMJ arthroscopy between 3/2014 and 3/2016 and also had TMJ MRI examinations performed within the 6 months prior to arthroscopy were identified. All subjects were imaged on a 3 Tesla system (Philips Ingenia; Best, Netherlands) using a head coil. Clinical data was recorded, including age and timing of MRI relative to arthroscopy. MRI examinations were retrospectively reviewed by two pediatric radiologists in consensus. The following data were recorded: subjective presence of synovitis, condylar shape, erosions, bone marrow edema, joint effusion, synovial thickness and enhancement (maximum TMJ synovial post-contrast signal normalized to temporal lobe white matter). Arthroscopy findings were documented at the time of surgery by a single pediatric oral-maxillofacial surgeon and included: subjective presence of active synovitis, hyperplastic synovitis (indicating chronic inflammation), increased vascularity and adhesions. In patients with bilateral arthroscopy, each joint was assessed separately.

Conclusions: Increased thickness of the synovium at MRI may be a useful indicator of chronic synovitis. Subjective evidence of synovitis and enhancement at MRI showed a strong trend toward correlation with chronic synovitis, and may also be useful. Interestingly, subjective evidence of synovitis at MRI did not correlate with subjective evidence of active synovitis at arthroscopy.

MISADVENTURES IN PEDIATRIC FACIAL FRACTURES RESULTING IN THE NEED FOR ORTHOGNATHIC SURGERY

Author and Presenter: Timothy A. Turvey, DDS

Introduction: With the introduction of bone plates and screws for facial fracture management, an increasing number of non-dentally trained surgeons attempting to manage these complex problems has increased. Subsequently the number of patients seeking care to improve their situation following pediatric facial trauma has also increased.

Purpose: The purpose of this study is to review a series of patients who have presented for facial reconstruction after being treated for pediatric facial fractures.

Materials and Methods: A series of patients who fit the study criteria including the subsequent need for orthognathic surgery will be analyzed. The demographics, facial fracture type, problem and presentation and type of surgery required will be delineated.

Results: The most frequent problems with facial fracture management included inappropriate reduction of fracture, inappropriate post-operative management especially with condyle fractures, over use of hardware without removal and subsequent growth disturbances. The most frequently required orthognathic surgery included mandibular and maxillary osteotomies.

Conclusion: When treating pediatric facial fractures:

1. Occlusion remains the most appropriate guide to reduction
2. When open reduction and internal fixation are used, avoiding underlying tooth buds is important
3. Removal of hardware after fracture healing will help avoid growth disturbance and may promote dental eruption
4. Closed treatment of condyle fractures with appropriate control of the position and projection of the mandible and restoration of movement remains the treatment of choice
5. Subsequent facial osteotomies may be needed to optimize the outcome

TREATMENT ALGORITHM FOR TREATING CONDYLAR AND HEMIMANDIBULAR HYPERPLASIA WITH COMPUTER ASSISTED ORTHOGNATHIC SURGERY

Authors: David M. Wilson DMD, MD; Sean P. Edwards DDS, MD

Presenter: David M. Wilson, DMD, MD

Introduction: Condylar and hemimandibular hyperplasia (CH and HH) is a maxillofacial deformity that can present with varying degrees of facial asymmetry. CH and HH etiologies include trauma, neoplasm, infection, or aberrant non-somatic growth of the mandible, which results in vertical, anterior-posterior, and transverse dimension asymmetry in the dentofacial complex. It is the goal of the Oral and Maxillofacial surgeon to treat asymmetry to provide patients with stable facial harmony. However, the more severe the deformity the greater it is to provide surgical outcomes that are not compromised. The advent of computer tomography and computer assisted techniques allows the surgeon to provide a comprehensive surgical plan to improve patient management. It is the goal of the authors to present an algorithm in treatment planning patients with CH and HH.

Methods: Algorithm was used on patients with a diagnosis of condylar hyperplasia or hemimandibular hyperplasia. Patients had orthodontic preparations with fixed appliances in both arches. They all underwent preoperative computer assisted surgical planning with Medical Modeling.

Algorithm Description: Using computer assisted surgery we assess the remaining skeletal asymmetry. Each area of the mandible is examined and planned separately to allow for proper restoration of facial symmetry. This includes the mandibular angle, chin, inferior border, and submental yaw discrepancies.

Conclusion: Surgical corrections of patients with condylar and hemimandibular hyperplasia have been described previously in the literature. Our surgical technique is a modification previously described by Ferguson (2005) and Jansen (1994). However, the literature does not describe using computer assisted surgery as an adjunct to restoring dentofacial symmetry. To date, an algorithm has not been developed to overcome the technical and anatomical difficulties when treating these severe facial deformities. Computer assisted orthognathic surgery can be used to provide better aesthetic and functional results, decrease operating room time, and decrease morbidity with preplanned correct anatomical movements.

PEDIATRIC HEAD AND NECK DESMOID FIBROMATOSIS: A CASE SERIES

Authors: Pantzlaff, E and Edwards, SP

Presenter: Edward Pantzlaff, DDS

Purpose: Assess management strategies and outcomes in a series of pediatric head and neck desmoid fibromatosis tumors in a single maxillofacial unit.

Materials and Methods: A chart review for all cases of pediatric head and neck desmoid tumors treated by the senior author (SPE) between 2006-2016 was completed. Patient demographics, treatment modalities and patient outcomes were recorded.

Results: Seven cases of head and neck desmoid tumors were identified. Patients ranged in age from 9 months to 10 years. Four patients were male and three were female. Five cases were perimandibular, one case was orbito-nasal and one case presented with extensive involvement of the mandible, maxilla, orbit and skull base. Follow up ranged from 1 month to 9 years. Two patients underwent preoperative chemotherapy both with poor tumor response. No patient underwent radiation therapy. All cases were subjected to surgical excision. Efforts were made to achieve negative surgical margins unless this would sacrifice vital structures. A recurrence rate of approximately 30% was achieved. Genetic sequencing of the most recent patient revealed a somatic point mutation in the β -catenin gene, CTNNB1 with potential therapeutic implications.

Conclusions: Desmoid tumors remain an aggressive entity in the head and neck with significant potential for recurrence and surgical morbidity. Conservative surgical excision is advocated given the variable associate between margin status and recurrence and an interest in limiting surgical morbidity. Genetic sequencing has revealed a potential therapeutic target in one case, that of an mTOR inhibitor for CTNNB1 mutations, which is currently subject of a clinical trial. In the future, routine tumor sequencing may reveal additional therapeutic options that reduce the risk of recurrence and morbidity of this disease.

PRESSURES ASSOCIATED WITH MEDICAL SCHOOL CURRICULAR AND MEDICAL LICENSURE. SURVEY OF U.S. DUAL DEGREE PROGRAM DIRECTORS

Author and Presenter: Sean Edwards, MD, DDS

Purpose: Medical school curricula are undergoing major changes in the United States in an effort to make medical school education more efficient and higher yield. These changes may pose problems for dual degree OMS residency programs that offer advanced standing in medical school to their trainees. Furthermore, states are increasing their requirements for the amount of ACGME accredited postgraduate training required for medical license eligibility that may create a downstream roadblock for graduates of these programmes. Understanding the magnitude of these problems is critical to finding solutions that ensure the success of our training programs.

Materials and Methods: A web based survey was created to assess:

1. To impact of medical school curricular changes on OMS training programmes.
2. To assess the presence or absence of difficulties in obtaining medical licensure post-residency and the different ways programs have approached ACGME certification for medical licensure.

This instrument was sent out to all residency program directors where an MD granting dual degree training exists.

Results: Results of the survey will be discussed in an effort to foster discussion and collaborative problem solving for any challenges identified.

INTEGRATING THE MEDICAL SCHOOL OF THE FUTURE INTO OMS RESIDENCY

Authors: Adam P. Fagin, DMD, MD; Mark E. Engelstad, DDS, MD, MHI

Presenter: Adam P. Fagin, DMD, MD

Purpose: In 2013, the American Medical Association expressed concern that traditional medical school curricula were no longer adequate to prepare students for an increasingly complex health care delivery system. In response, they launched the *Accelerating Change in Medical Education Consortium*, made of eleven medical schools, including OHSU, to introduce innovations in medical education. Some of these changes will have a major impact on OMS/Medical School integration. We will discuss how the OHSU OMS program adapted to these changes and worked with its medical school to improve the overall OMS residency curriculum.

Methods: The change that had the greatest effect on OMS integration was the adoption of a competency-based medical school curriculum. In this model, the traditional '2+2' model of two years science + two years clinical is replaced by an individualized, competency-based curriculum in which students make progress by demonstrating mastery at certain milestones, rather than cumulative 'chair time'. This change eliminated the traditional pauses in the medical school curriculum where OHSU OMS residents were being integrated into a medical school class, forcing the program to redesign its medical school component and, consequently, its entire OMS curriculum. We will discuss how to take advantage of these changes by presenting OMS residents as advanced learners who are well suited to thrive in a competency-based curriculum, as well as how the School of Medicine is assessing OMS residents in our program.

Conclusions: With OMS/ Medical School integration, our goal is to maximize total months of OMS experience, minimize redundancy and interruption, maximize continuity, and progress logically from the basics of medical school through specialized surgical training. The new medical school curriculum changes can present obstacles as well as great opportunities to realize these goals.

DEVELOPMENT OF A COMPUTATIONAL FRAMEWORK FOR ASSESSMENT OF SURGICAL EXPERIENCE

Authors: Quinn Walker; James Morrison, MD; Mark Engelstad, DDS, MD, MHI

Presenter: Mark Engelstad, DDS, MD

Purpose: Surgical logs are a potential source of rich educational information but they are saved in billing terms that computers can't translate into educational important concepts. To make use of logs, computers must understand queries like, "What structures are involved in this finding?" and "What processes occur during this procedure?" To solve this problem, we've developed a richly annotated framework of surgical structures and processes, designed to answer highly specific queries about surgical education. Currently, no such educational specific framework exists in any surgical domain.

Methods: We scoured existing knowledge sources (OMS texts, medical terminologies) to create a comprehensive set of OMS-related findings (n=3750) and procedures (n=2500). Each of these concepts was labeled with its most common term and annotated with its synonyms and any existing billing codes. 65% of concepts did not have a matching billing term. Next, we created a logically consistent taxonomy of surgical anatomy, abnormal structures, and surgical objects along with a novel taxonomy of surgical processes, enabling highly specific queries of surgical logs.

These OMS educational concepts and the relationships between them were connected in a graph database using a logical schema that can be expanded to any surgical domain. OHSU residency concepts and log data were added. A secure surgical log application was developed upon this database. The log's user interface was designed to decrease cognitive load and increase speed through use of natural language, synonyms, and autocomplete, making use of billing terms possible, but unnecessary.

Conclusion: Log data is valuable but underutilized. A surgical log application optimized for easy search using natural language, along with a richly annotated database of surgical concepts, work effectively together to translate log data into useful and timely educational information for surgical learners and teachers. These ideas, database, log application, and the information they deliver will be demonstrated.

3D PRINTING AND VIRTUAL SURGERY PLANNING APPLICATIONS FOR ORAL AND MAXILLOFACIAL SURGERY RESIDENT EDUCATION AND TRAINING

Authors: Travis Hamilton, DMD, MD; Steven M. Roser, DMD, MD, FACS; Dina Amin, BDS; Shelly Abramowicz, DMD, MPH

Presenter: Travis Hamilton, DMD, MD

Purpose: To present current 3D printing and virtual surgery planning (VSP) technologies and applications in Oral and Maxillofacial Surgery (OMS) training.

The current surgical training environment emphasizes patient safety and outcomes despite restrictions in surgical resident work hours.¹ This combination, while overall beneficial for patients and residents, may result in decreased exposure to the technical aspects of surgical training. 3D printing and VSP provide repetition and exposure to high fidelity, inexpensive models to improve technical surgical skills while providing tactile feedback without risk of patient harm.²

3D printing and VSP have made significant impacts on the practice of OMS.³ Advances in software and a decrease in cost allowed access to 'desktop' 3D printers. This is an ideal situation for OMS to take advantage of rapid prototyping and integrate these tools into surgical training. Some surgical specialties have produced preliminary literature with innovative application of 3D printing and VSP for surgical training. Otolaryngology demonstrated a low cost training model for temporal bone surgery.⁴ Plastic surgery developed a method for modeling the nasal tip elasticity using 3D printing and silicone molds⁵ and cleft palate pathology.⁶ The OMS community produced multiple applications for 3D printing in trauma and dental implant surgery.²

The Emory OMS division recently implemented in house 3D printing as a component of patient care. It is routinely used in training of residents and while planning treatment of surgical cases. This presentation will provide a review of 3D printing technology, and the necessary equipment and facilities for a 3D printing lab. Clinical case examples will be presented.

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QUALITY AND SAFETY MEASURES REMAIN CONSTANT FOLLOWING A CHANGE IN AN ELECTRONIC HEALTH RECORDS SYSTEM

Author: Yisi D. Ji, Edward T. Lahey III DMD MD

Presenter: Yisi D. Ji

Purpose: The purpose of this study is to determine if transitioning from an institutionally developed and managed local electronic health record (EHR) to a proprietary, national EHR system leads to changes in quality and safety measures at a large, urban, tertiary care medical center.

Methods: This is a prospective study completed at the Massachusetts General Hospital Department of Oral and Maxillofacial Surgery (OMS) between March 2016 and October 2016. Objective and subjective quality measures were measured before and after a new EHR was implemented. Objective measures included number of safety reports filed, number of reported departmental complications, completeness of vital signs and smoking status recordings in patient records. Records of patients who received consults for third molar extractions under IV sedations were chosen to be assessed one month prior to and six months after implementation. The problem lists of patient records were compared to determine completeness before and after implementation. Subjective measures were derived from a validated survey given to faculty, residents and staff (administrative, nursing, and ancillary) in the OMS department and included patient-provider communication, inter-provider communication, inter-organizational communication, work-life changes, improved care, support and resources, and patient-care processes domains. The surveys were given prior to implementation (T0), at 3 months (T1), and 6 months (T2) post-implementation. Members of the department were excluded if they were unable to complete at least two surveys. Descriptive statistics were calculated with Fisher’s Exact test.

Results: Thirty-seven subjects were eligible to be included in this study. A total of 24 subjects were included in this study. The response rate at T0 was 83.3% (21/24), at T1 was 95.8% (23/24), and T2 was 54.1% (13/24). There were no significant changes in domains of patient-provider communication, inter-provider communication, inter-organizational communication, improved care, support and resources, and patient care processes. Though not significant, there was a negative trend in work-life change amongst respondents. Age was not a predictor of user experience satisfaction. There was no increase in safety reports or number of complications throughout implementation of the EHR. Smoking status was more often documented in structured data after implementation of the new EHR (p=0.0001). There was no difference in number of problems listed between the two EHRs (p>0.05). There were no differences in vital signs documentation (p>0.05).

Conclusion: Changing an EHR at this large academic medical center had little effect on measures of quality and safety within the first 6 months of implementation. Smoking status was better captured and overall, surgeons and staff adapted well to the transition. Long-term follow-up will be completed to determine if late changes in measures occur.

Table 1 Bivariate analysis of Documentation of Smoking Status

	Smoking Status Not Documented	Documented	Total
Prior to new EHR	16	11	27
6 months after new EHR	0	15	15
	16	26	42

Fisher’s Exact test p=0.0001

Table 2

Month	Number of Safety Reports	Number of Complications
March 2015	3	5
April 2015	3	8
May 2015	3	1
March 2016	4	1
Apr 2016 *	2	4
May 2016 *	3	3
Oct 2016 *	7	6

*Months are after new EHR implementation p>0.05

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CLEFT AND CRANIOFACIAL TRAINED ORAL AND MAXILLOFACIAL SURGEONS: CAN WE SURVIVE?

Author and Presenter: Pat Ricalde, MD, DDS

Materials and Methods: Cleft and Craniofacial trained Oral and Maxillofacial Surgeons are compared to Cleft and Craniofacial trained Plastic Surgeons using information gleaned from the internet.

Results: Cleft and Craniofacial trained Oral and Maxillofacial Surgeons may be better trained to manage pediatric patients with congenital deformities, but are present in much smaller numbers as compared to Plastic Surgeons.

Conclusions: Cleft and Craniofacial trained Oral and Maxillofacial Surgeons are a quiet minority within our specialty. This review highlights some challenges we face, and offers some suggestions for increasing our numbers.

EVALUATION OF ORAL AND MAXILLOFACIAL SURGERY RESIDENTS' OPERATIVE SKILLS: FEASIBILITY & ENGAGEMENT STUDY USING *SIMPL* SOFTWARE FOR A MOBILE PHONE

Authors: Leonard B. Kaban, DMD, MD; Brian George, MD, Edward Lahey, DMD, MD; Jordan Bohnen, MD; Maria Troulis, DDS

Presenter: Leonard B. Kaban, DMD, MD

Purpose: To determine the feasibility of using a smart-phone application to achieve a high rate of timely evaluations of trainees' operative skills and timely resident communication. We hypothesized that these goals would be achieved because the process is convenient, easy and fast.

Methods: This is a prospective feasibility study for the use of *SIMPL*, to evaluate residents' operative skills. *SIMPL* (System for Improving and Measuring Procedural Learning) requires the attending surgeon to answer 3 multiple choice questions: 1. What level of help (Zwisch scale) was required by the trainee? 2. What was the level of performance? 3. How complex was the case? The evaluator can also dictate a 30 second narrative. The responses are captured in real time. The sample was composed of 3 faculty surgeons and 3 senior residents. Predictor variables were the surgeons, trainees and procedures performed. Outcome variables included: number and percent procedures performed by faculty/resident pairs assessed; time required to complete assessments; time lapsed to submission; percent assessments with narratives; residents' response rates (self-assessments) to evaluations; Zwisch, performance and difficulty ratings by procedure.

Results: From March through June 2016, 187 procedures were performed by faculty subjects including 151 procedures together with participating residents. There were 107 assessments submitted (71% of procedures). Residents' response rate (self assessments) to evaluations was 81%. Recorded time to complete assessments (n=75/107) was under 2 minutes. Time lapsed to submission was < 72 hours (100%). Dictations were submitted for 35 evaluations (33%). For Le Fort I, BSSO and genioplasty, resident progression in type of help and performance ratings were documented.

Conclusions: The results of this feasibility study indicate that use of *SIMPL* results in a high percentage of timely intra-operative trainee evaluations, high participation by residents and provides data on progression of resident skill sets. We plan a prospective trial with participation by all residents and faculty and a broader range of procedures.

BRIDGING THE SPECIALTY DIVIDE: ORAL & MAXILLOFACIAL SURGERY AND THE AMERICAN COLLEGE OF SURGEONS – A BRIEF HISTORY

Author and Presenter: Shahid R. Aziz, DMD, MD, FACS

Purpose: 2016 was a historic year for American OMS – it marked the first year that qualified (non-medically licensed) oral and maxillofacial surgeons were accepted for fellowship in to the most influential and significant surgical organizations in the United States – the American College of Surgeons. The following presentation reviews the surprising long relationship between American OMS and the ACS

Methods: Historical review – personal communications, review of the Journal of the American College of Surgeons

Conclusions: American OMS has a surprisingly long and varied relationship with the ACS. The latest chapter in this relationship places American OMS in an excellent position to have a role in the future of American Surgery.

THE IMPACT OF SURGICAL MISSIONS ABROAD ON THE OMS RESIDENT

Author and Presenter: Vincent Carrao, DDS, MD

Global surgery programs have attracted considerable interest in the last two years as a result of the 68th World Health Assembly (WHA) resolution WHA68.15 on May 22 2015, “Strengthening emergency and essential surgical care and anesthesia as a component of universal health coverage (UHC).” For the first time, governments worldwide acknowledged and recognized surgery and anesthesia as key components of UHC and health systems strengthening.

Many oral and maxillofacial surgeons currently volunteer for humanitarian mission with various organizations, often times residents will accompany faculty on some of these missions. The residents can learn a variety of lessons in an environment that can be vastly different from our home institutions. Some of the important learning points include diagnosing and surgical management of deformities that are uncommon in the United States; thus increasing their knowledge base, surgical skill set, and a greater awareness of global medicine and its many challenges. This experience may inspire young surgeons to continue to give back as they progress in their careers.

UTILIZATION OF INTRAOPERATIVE CT IN CRANIOMAXILLOFACIAL TRAUMA SURGERY

Authors: Karl K Cuddy MD, DDS, MSc; Baber Khatib MD, DDS; R Bryan Bell MD, DDS, FACS, FACD; Allen Cheng MD, DDS; Ashish Patel MD, DDS; Melissa Amundson DDS; Eric J Dierks MD, DMD, FACS, FACD

Presenter: Karl K Cuddy MD, DDS, MSc

Purpose: Reconstruction of complex injuries and deformities of the facial skeleton requires accurate restoration of three-dimensional anatomic relationships, stable fixation and appropriate post-operative wound healing. Intraoperative assessment is often difficult due to distortion of predictable surgical landmarks, loss of tissue and/or swelling associated with trauma. If the initial reconstruction is not accurate and fails to restore normal craniomaxillofacial relationships, patients may require multiple secondary operations to correct and refine the deformity. Intraoperative CT has gained popularity in craniomaxillofacial reconstructive surgery over the past 10-15 years and is now utilized by many centers. With increased availability of intraoperative CT, it is becoming important to identify when and how to appropriately use this technology to balance the benefit of intraoperative information with the cost and radiation exposure associated with use.

Methods: A retrospective review of the use of intraoperative CT for craniomaxillofacial surgery at Legacy Emanuel Medical Centre was performed. We sought to characterize the utilization of the intraoperative CT for craniomaxillofacial surgery within our institution, to quantify the effect of intraoperative CT on surgical decision-making and to identify which injury patterns/patients benefit most from this investigation.

Results and Conclusion: 212 intraoperative facial CT scans on 161 patients over 168 operations were analyzed. A single intraoperative CT was performed in 130 cases, two scans were performed for 32 cases while three scans were obtained for 6 cases. In cases with multiple intraoperative CT scans, changes in reduction or fixation were performed after each CT scan. Additionally, 9 cases had a modification in plating or reduction after a single CT scan without follow-up scan. CT directed revision rates were calculated for individual fracture patterns (Orbital: 31%, ZMC: 24%, LeFort 2/3: 23%, NOE: 23%, Mandible: 19%) and recommendations for intraoperative CT use generated based on this experience.

THE USE OF INTRAOPERATIVE CT SCANS FOR MAXILLOFACIAL TRAUMA

Author and Presenter: Edward Ellis, III, DDS, MS

Until recently, Oral and Maxillofacial Surgeons have not routinely obtained intraoperative images to verify the adequacy of reduction or reconstruction of fractured bones of the face. The reason for this is that plain radiographs could not readily visualize the complex anatomy of the midface. Over the past few years, accurate 2-dimensional and 3-dimensional imaging has become possible with the introduction of mobile C-arm CBCT units.

This presentation will demonstrate how intraoperative CBCT scans can completely change the way patients are treated with maxillofacial injuries. Specifically, the treatment of cases of ZMC fractures, internal orbital fractures, and nasal fractures will be shown to demonstrate how intraoperative CBCT can often decrease the invasiveness but increase the accuracy of reconstructive trauma surgery.

FRACTURE HEALING AND BONE REGENERATION USING DEGRADABLE MAGNESIUM FIXATION PLATES AND SCREWS WITH AND WITHOUT POLYMER MEMBRANES

Authors: Moore C, Costello BJ, Brown A, Chaya A, Yoshizawa S, Verdelis K, Myers N, Chou DT, Pal S, Maiti S, Kumta PN, Sfeir C

Presenter: Christian Moore, DMD

Internal bone fixation devices made with permanent metals are associated with numerous long-term complications and may require removal. We hypothesized that fixation devices made with degradable magnesium alloys could provide an ideal combination of strength and degradation, facilitating fracture fixation and healing, while eliminating the need for implant removal surgery. Methods: Fixation plates and screws were machined from 99.9% pure magnesium and compared to titanium devices in a rabbit ulna fracture model. Magnesium device degradation and effect on fracture healing and bone formation was assessed after four weeks. We also utilized a unique magnesium and polylactide membrane for bone regeneration. Fracture healing and bone healing/regeneration with magnesium device fixation was compared to that of titanium devices using qualitative histological analysis and quantitative histomorphometry. Results: Microcomputed tomography showed device degradation after four weeks in vivo. In addition, 2D microCT slices and histological staining showed that magnesium degradation did not inhibit fracture healing or bone formation. The magnesium and polymer construct with screws degraded as expected with significant bone regeneration vertically at the ridge. Histomorphology revealed no difference in bone bridging fractures fixed with magnesium and titanium devices. Interestingly, abundant new bone was formed around magnesium devices, suggesting a connection between magnesium degradation and bone formation. The vertical augmentation constructs produced significant bone vertically. Conclusion: Our results demonstrate potential for magnesium fixation devices in a loaded fracture environment. Furthermore, these results suggest that magnesium fixation devices may enhance fracture healing by encouraging localized new bone formation. We exploited this new understanding by manufacturing a polymer membrane with magnesium as a component which generated vertical ridge augmentation in a novel manner.

APPLICATION OF VIRTUAL SURGICAL PLANNING TO STAGED MANAGEMENT OF SELF-INFLICTED GUNSHOT WOUNDS TO THE MAXILLOFACIAL SKELETON: THE OREGON PROTOCOL

Authors: Baber Khatib MD, DDS; Karl Cuddy MD, DDS; Savannah Gelesko, MD, DDS; Melissa Amundson DDS; Allen Cheng, MD, DMD; Ashish Patel MD DDS; Eric J. Dierks MD, DMD, FACS FACS;

R. Bryan Bell MD, DDS, FACS, FACS

Presenter: Baber Khatib, MD, DDS

Purpose: Complex facial reconstruction after major ballistic trauma continues to be challenging [1,2] We created a protocol for maxillofacial reconstruction after complex ballistic injury that utilizes staged reconstruction using computer-aided surgery in the primary hospital setting. The purpose of this investigation is to review our experience with virtual surgical planning in the setting of high velocity gun shot wounds to the face and propose a treatment protocol.

Methods: All patients with complex, avulsive, high velocity gunshot wounds who were managed according to a defined protocol utilizing computer-aided design/computer aided manufacturing (CAD/CAM) software between 2010-2016 were identified by retrospective chart review. The protocol involves a staged approach to surgical reconstruction, beginning with: 1) damage/hemorrhage control, airway stabilization, and maxillo-mandibular stabilization as indicated; 2) debridement of non-viable bone and soft tissue; 3) virtual reconstruction using commercially available craniomaxillofacial computer program and “back-conversion” of virtual plan into navigation system; 4) navigation assisted reconstruction of midfacial skeletal anatomy; 5) computer aided oro-mandibular reconstruction with or without microvascular free tissue transfer using custom guide stents and cutting guides; 6) navigation assisted, computer aided palatomaxillary reconstruction with microvascular free tissue transfer using cutting guides and guide stents as indicated; 7) navigation assisted reconstruction of the internal orbit; 8) confirmation of accurate reconstruction using intraoperative CT imaging.

Data Analysis: Data analysis for this retrospective case series is limited to descriptive statistics obtained via chart review. Subjective comparison of the computer-assisted presurgical plan to the postoperative CT scan was completed intraoperatively. Jaw position, facial projection, separation of the nose and mouth, and oral competence was evaluated postoperatively at least one month after surgery.

Results: All patients had severe disruption of the orbits, midface and mandible, with massive hard and soft tissue avulsion and oral-nasal communication. The computer-assisted surgery was successfully implemented in all patients and proved to be a useful adjunct for: the restoration of orbital volume, facial projection and symmetry; the inset of composite tissue free flaps, and the facilitation of dental implant supported prosthetic rehabilitation. Of the nine self inflicted gunshot wounds, 3 arrived spontaneously ventilating and were orally intubated for airway protection, 1 arrived with a cricothyrotomy and the remaining 5 were orally intubated on arrival. The average number of operating room visits during the initial hospitalization was 4.7 and hospital course ranged from 7-59 days. All patients were treatment planned with virtual surgical planning, 1 patient underwent rigid fixation without grafting, 2 patients were reconstructed with non-vascularized bone grafts and 6 received microvascular free flaps. Four received a single fibula for mandibular reconstruction, 2 received a double fibula reconstruction of both maxilla and mandible and one received a fibula for the mandible a radial forearm for reconstruction of the midface. All three patients reconstructed without microvascular tissue became infected.

All patients survived their hospitalization, were decannulated prior to discharge, had adequate midface and mandibular projection, fair oral competence and intelligible speech.

Conclusion: Virtual surgical planning for complex ballistic injury facilitates efficient and accurate primary reconstruction.

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PRELIMINARY EXPERIENCES WITH IN-HOUSE VIRTUAL SURGICAL PLANNING AND 3D PRINTING IN MAXILLOFACIAL ONCOLOGY AND MICROVASCULAR RECONSTRUCTION

Authors: Kevin Arce DMD, MD; Kyle S. Ettinger, DDS, MD; Amy E. Alexander BSBME; Jane M. Matsumoto, MD; Jonathan M. Morris, MD

Presenter: Kevin Arce, DMD, MD

Purpose: Interpretation of three-dimensional anatomical information from 2D cross-sectional images in tumor resection and maxillofacial reconstruction can be challenging due to the complex bony anatomy and close proximity of vital structures. To aid in this, three-dimensional (3D) printing has increasingly become an essential component of oral and maxillofacial surgery. It's routine application in the areas of surgical planning, patient education, and fabrication of custom implants has facilitated the care of patients with complex maxillofacial deformities. Advances and availability in software and 3D printers has made this technology more accessible and even allowed its use in the "bedside" care of patients. [1] The purpose of this study is to review a single institution's experience with in-house surgical planning and 3D printing in patients with maxillofacial pathology and acquired defects and its impact on clinical care and surgical education.

Materials and Methods: A retrospective cohort study design from a sample of consecutive subjects who underwent virtual surgical planning and/or 3D printing and fabrication of custom implants at the Mayo Clinic, Rochester for maxillofacial pathology and reconstruction was performed. The primary aim was to characterize the process of optimizing the radiographic imaging for 3D visualization and printing, virtual surgical planning, and rapid fabrication of patient specific custom implants and 3D printed surgical guides. Secondary aim was to assess the surgical team's confidence with the plan of care and educational value of 3D printed models of the maxillofacial bones, tumors, and surgical guides.

Results: The study sample was composed of 11 subjects, 8 males and 3 females with an average age of 51 years (range 20-86). There were 2 maxillary, 8 mandibular and 1 combined maxillary and orbital floor defect. Ameloblastoma was the most frequent diagnosis, with malignant pathology consisting of osteosarcoma, malignant ossifying fibromyxoid tumor and squamous cell carcinoma. The surgical treatment plans were performed in house shortly (1-3 days) after imaging with a radiologist, surgeon and biomedical engineer. The 3D anatomic models and patient specific osteotomy guides were printed without delaying care and impacting outcomes. Satisfaction in the utility of the intraoperative 3D printed models for clinical and educational purposes was high.

Conclusions: In-house virtual surgical planning and 3D printing provide a reliable, predictable and readily accessible tool for the care of patients with maxillofacial pathology. It allows for direct interaction between the surgeon, radiologist and engineer in the rapid prototyping and customization of surgical guides and implants. 3D computer visual models allow for representation of the regional anatomy during treatment planning but rely on the spatial capabilities of the surgeon and are limited by their accessibility during a surgical procedure. 3D printed models provide tactile manipulation and a better understanding of the spatial relationships of the tumor to the surrounding bony structures intraoperatively. While the visuospatial advantages of physical models have been established in teaching anatomy [2], future studies should objectively assess the direct impact of 3D printed anatomic visualization in clinical/surgical practice and patient related outcomes.

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IS VIRTUAL SURGICAL PLANNING ACCURATE IN PREDICTING MAXILLARY POSITION WHEN PERFORMING MANDIBULAR SURGERY FIRST?

Authors: Biraj Shah, John Caccamese, Sean Edwards, Tarik Kramcha

Presenter: Biraj Shah, DDS

VSP (virtual surgical planning) has been transformative in the planning of orthognathic surgery. It has promoted more accurate planning of osteotomies in all three dimensions of space. Advantages of the technique include more accurate diagnosis and treatment of asymmetries, the ability to assess surgical feasibility, the ability to evaluate relevant anatomy, as well as significantly decreasing the amount of surgical preparation time. It also allows allow the surgeon to easily move between performing maxillary or mandibular surgery first, as it has eliminated the cumbersome process of reverse model surgery. Based on clinical observation, it appears, however, that osteotomy gaps at the maxilla are smaller than the planned gaps when performing mandible surgery first. This despite sometimes exaggerated gaps at the mandibular osteotomy. This audit of results aims to evaluate whether there is a gap prediction problem with the VSP technique and whether this also affects incisor position.

Methods: Twenty consecutive patients from 2 institutions were evaluated. 10 maxillary surgery first, 10 mandibular surgery first. Postoperative CBCT scans were obtained within 6 weeks of surgery and overlays were performed with the VSP plan. Specifically, maxillary and mandibular osteotomy gaps were measured, along with incisor position.

Results: While there was variability in all of the maxillary gaps that were measured, there was more variability noted in the mandible first cases and the incisor position was not as badly affected. This variability may be due to tipping of the maxilla in the splint in segmental cases as well as the arc of rotation of the mandible, or changes in the vertical positioning of the incisor.

CEPHALOMETRIC AIRWAY AND SKELETAL STABILITY FOLLOWING MAXILLOMANDIBULAR ADVANCEMENT FOR SEVERE OBSTRUCTIVE SLEEP APNEA WITH LONG-TERM FOLLOW-UP

Authors: Joseph E. Cillo Jr., DMD, MPH, PhD; FACS; David J. Dattilo, DDS

Presenter: Joseph E. Cillo Jr., DMD, MPH, PhD

Statement of the Problem/Purpose: There is a lack of data on long term cephalometric skeletal and upper airway stability following maxillomandibular advancement (MMA) for obstructive sleep apnea (OSA). The purpose of this study was to determine the long term skeletal and airway stability of subjects who had undergone MMA for OSA.

Subjects and Methods: This was a retrospective cohort analysis of adult patients treated with MMA for polysomnogram (PSG) confirmed severe OSA over a 22-year period. Inclusion criteria included severe OSA (AHI > 35), age 18 or over, and treatment with maxillomandibular advancement (MMA) of at least 8 mm, adequate pre- and post-operative lateral cephalometric radiographs, and at least 5 years of follow-up. Exclusion criteria included insufficient chart data, lack of rigid fixation, and inability or unwillingness to participate in the study. Predictor variables were the presence of OSA and treatment by MMA. Outcome variables were airway and skeletal stability based on cephalometric tracings for 4 upper airway landmarks and SNA, SNB, and ANB. Using computerized software (Dolphin Imaging 10.0, Carlsbad CA), lateral cephalometric radiographs were digitized and standardized for 3 time points, T0 (pre-operative), T1 (1-week post-operative), T2 (follow-up at least 5 years). The Arnett-Gunson FAB cephalometric analysis was utilized to determine the anterior-posterior cephalometric length of the nasopharyngeal airway at the Point A level (PtA), oral pharyngeal airway at the maxillary incisal level (Mx1), hypopharyngeal airway at the Point B level (PtB), and the deep pharynx airway at Pogonion level (Pog) at each time point. The Steiner analysis was utilized to determine skeletal stability by analyzing the changes in skeletal landmarks SNA, SNB, and ANB. Incidence of malocclusion was determined through clinical and photographic examination.

Methods of Analysis: *A priori* sample size analysis to detect a significant difference between means of dependent groups with the two-way paired t-test using an alpha error of 0.05, a power of 95%, and based on data from both Butterfield et al and Lee et al found that a total of ten subjects would be required (airway and skeletal, respectively). Statistical significance between group means was determined using the two-way paired t-test with significance set at the $p < .05$ level.

Results: Ten subjects who met the inclusion criteria were included in this study. The average time of follow-up was 8.7 years with an average age of 57.9 +/- 9.0 years with equal gender distribution. Pre-operative AHI was 59.8 +/- 17.9. The average maxillomandibular advancement was 8.75 mm at maxillary central incisor, all patients received rigid fixation and an average period of maxillomandibular fixation of 3.5 weeks. There were statistically significant increases between T0 and T1 and between T0 and T2 for all airway (PtA, Mx1, PtB, and Pog) and skeletal (SNA and SNB) measurements. There were small statistically insignificant relapses between T1 and T2 for all airway and skeletal measurements (PtA, Mx1, PtB, Pog, SNA, SNB, and ANB).

Conclusion: Long term cephalometric skeletal and airway stability is achievable with small statistically insignificant relapse following maxillomandibular advancement surgery for obstructive sleep apnea.

FRACTURE OF ALL TITANIUM PLATES USED TO FIXATE LEFORT I OSTEOTOMY IN PATIENT WITH OBSTRUCTIVE SLEEP APNEA AND PARAFUNCTIONAL HABITS – A CASE REPORT

Author: Zahid Lalani, DDS, PhD, MBA, FDSRCS (England), FFDRCS (Ireland)

Presenter: Zahid Lalani, DDS, PhD, MBA

Purpose: This is a case report that highlights the need for pre-operative evaluation of occlusal forces in patients with significant para-functional habits and use of Botox and custom occlusal splints prior to surgery to avoid potential complications following maxillary and mandibular osteotomies. There is no reported case in the English literature documenting fracture of all plates used for fixing a maxillary osteotomy due to significant parafunctional habits.

Case Report: We present a case of a 34 year old male patient diagnosed with severe obstructive sleep apnea who was treated with a LeFort I maxillary osteotomy with advancement and mandibular sagittal ramus osteotomy with advancement and rigid internal fixation. Patient was a professional boxer who had discontinued participation in the sport 10 years prior to the surgery, but had a history of clenching.

The patient presented with mobility of the maxilla 6 months post-surgery and was taken to the operating room where it was noted that he had fractured all four of the 1.8 mm Stryker plates in the maxilla resulting in fracture of the maxilla.

The patient was treated with debridement of the fracture site, fixation with 2 mm plates, block grafts of cortico-cancellous bone, injection of Botox into the masseter muscles bilaterally and use of a custom occlusal splint.

Conclusion: It is critical to evaluate the severity of parafunctional habits in individuals being evaluated for facial osteotomies and use adjunctive modalities to counter these forces prior to and during surgery.

RECOMBINANT HUMAN BONE MORPHOGENETIC PROTEIN-2 IS NOT A RISK FACTOR FOR CANCER

Author and Presenter: *Robert E. Marx, DDS*

Purpose: Since clinicians of both orthopedics and oral and maxillofacial surgery have recently raised a legitimate concern about the risk for cancer development and promotion of tumor growth with the use of rhBMP-2/ACS (Infuse Bone Graft®-Medtronic)¹, a two cohort study was conducted to validate or refute this concern.

Methods and Materials: A two cohort study of 792 patients in which 396 received rhBMP-2/ACS and another 396 patients received an autogenous bone graft for major reconstructive procedures for the jaws.

Results: There was a nearly equal emergence of cancer in the group that received rhBMP-2/ACS group 8/396 (2.0%) as there was in the autogenous graft group 9/396 (2.3%)($p=0.91$).

Conclusions: There is no correlation of cancer emergence to the clinical use of rhBMP-2/ACS in real cases of jaw reconstruction as compared to an autogenous bone graft. There is also no known pathways for an external growth factor such as rhBMP-2/ACS to be mutagenic or to promote sustained tumor growth.² Therefore, there is no risk for cancer emergence in general clinical use in oral and maxillofacial reconstructive surgery.

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CUSTOM-FABRICATED ACRYLIC STENT USED FOR GRAFTING OF COMPLEX VESTIBULOPLASTIES IN THE FREE FLAP RECONSTRUCTED DEFECT

Authors: Andrew Meram, DDS, MD; Steven Patel, DDS, MD; Dongsoo David Kim, DMD, MD, FACS

Presenter: Andrew Meram, DDS, MD

The purpose of this study is to present and retrospectively evaluate the long-term success of a novel technique utilizing a custom acrylic stent to improve the success of complex vestibuloplasties of intraoral defects previously reconstructed with free flaps. A retrospective analysis was performed of patients treated by surgeons within the Department of Oral and Maxillofacial Surgery at LSUHSC – Shreveport from December 2011 to December 2016 who had undergone reconstruction of large intraoral defects with a free flap, with subsequent obliteration of the buccal vestibule of the mandible and/or maxilla. Those that then underwent implant placement to either the native bone or the neo-maxilla/mandible followed by a period of 4-6 months of osseointegration were further analyzed to include those who required vestibuloplasty. Of this group, 17 patients underwent vestibuloplasty and skin grafting utilizing a custom-fabricated acrylic stent. At the time of implant uncovering, intact periosteum was left overlying the bone, the flap was debulked, a skin graft (either split or full thickness) was placed over the resulting defect, and a custom-fabricated acrylic stent with a deep and buccally inclined extension was fixated to a minimum of 2 implants for a period of 4-10 weeks. The stent was removed in the clinic under local or mild/moderate conscious sedation depending on ease of access and patients' pain tolerance/anxiety level. Variables measured included vestibular depth, graft survival, and duration of stent fixation. Average depth of vestibule was maintained at 6mm in comparison to preoperative vestibular depth. All but 3 grafts survived with variable degrees of keratinized tissue remaining. Duration of stent fixation ranged from 4-10 weeks with no significant increase in graft survival after 6 weeks. This technique utilizing a voluminous, less bulky and less traumatic material that remains fixed in position allows for increased vestibular depth and adequate fixation to maintain graft survival.

SIALENDOSCOPIC MANAGEMENT OF SJÖGREN'S SYNDROME PATIENT: OBSERVATIONS AND OUTCOMES

Author and Presenter: Michael D. Turner, DDS, MD

Purpose: Sjögren's syndrome (SS) is an autoimmune disease that causes inactivation followed by sclerosis of the major salivary glands. Sjögren's patients present clinically with acute parotid swelling that is associated with obstruction of the salivary gland ducts by mucous plugs. The technology of sialendoscopy has allowed visualization, exploration and disruption of these mucous plugs. This is a retrospective review of a case series of 23 patients with confirmed diagnosis of SS, who underwent sialendoscopy and were followed for range that extends from two years to eleven years.

Methods: Eighteen of the patients were female and the remaining five were male (3.6:1 ratio), which is higher than the reported female to male ratio of 9:1. The average age of the patients, on initial presentation, was 47 with a range of 18-78. Sialendoscopes were introduced into the glands and disruption of the mucous plugs was performed followed by an intraductal injection of 10mg of triamcinolone.

Post-operatively, 14 patients (61%) of the patients were asymptomatic following one treatment. Of the patients who continued to be symptomatic, 6 patients (26%) underwent repeat sialendoscopy and are asymptomatic at this time. The repeated sialendoscopies were performed, on average, with a period of 14 months between procedures with a range of 6 to 26 months. Superficial parotidectomies were performed on 3 patients (13%) because of intractable pain and infection.

Conclusion: In Sjögren's patients, who have acute salivary gland obstruction, sialendoscopy can be used to disrupt the obstructing mucous plugs and enhance the delivery of topical steroids to the diseased tissue. Although not curative, a decrease in acute symptoms can be obtained.

NEUROPHYSIOLOGICAL MONITORING MAY REDUCE THE RISK OF FACIAL NERVE DAMAGE DURING PREAURICULAR DISSECTION TO THE TMJ

Authors: Matt DeMerle, Gary Gallagher, Sharon Aronovich

Presenter: Matt DeMerle

Purpose: The frontal (temporal) branch of the facial nerve (CN 7) is not typically visualized during preauricular dissection limiting the surgeon's ability to use direct nerve stimulation for monitoring. Since its location is highly variable, certain patients are at high risk for paresis or paralysis during the dissection or retraction of preauricular tissues. The purpose of this study is to describe the utility of intraoperative neurophysiological monitoring (IONM) during preauricular dissection to reduce the risk of CN 7 injury.

Methods: This is retrospective study including a case series of 7 patients who underwent TMJ surgery with the assistance of IONM of the facial nerve branches. We included patients who had preauricular dissection to the TMJ with The primary outcome variable was facial nerve function after surgery and the secondary outcome variable was the frequency of neurotonic discharges from the frontal and/or zygomatic branches of the facial nerve during surgery via the preauricular approach.

Conclusions: The use of continuous intraoperative neurophysiological monitoring increases the surgeon's awareness of traction placed on the frontal and zygomatic branches of the facial nerve and has the potential to reduce the incidence of temporary or permanent facial nerve paresis and paralysis.

DEMOGRAPHIC AND HISTOPATHOLOGIC CHARACTERISTICS OF STAGE 1 ORAL TONGUE CANCER: REVIEW OF 145 PATIENTS

Authors: Ord RA, Dyalram D, Lubek J

Presenter: Robert A. Ord, DDS, MD

Purpose: To review the demographics and histopathologic characteristics of patients with Stage 1 oral tongue cancer

Methods and Materials: This retrospective study examined all patients (347 cases) with a diagnosis of tongue cancer at the University of Maryland department of OMFS 2003-2013. 188 patients with stage 1 tongue SCC were identified. 43 patients were excluded leaving 145 clinical and pathologic Stage I SCC treated primarily surgically by WLE with SND for tumor depth >3mm.

Results: 75/145 were female (51.7%), 135 (93%) were Caucasian and 75 were never smokers (51.7%) with 47 (32.4%) having quit smoking. 98/145 (67.6%) had associated leukoplakia and 25 (17.2%) erythro-leukoplakia.

82/144 cases were <1cm (56.9%), 92/145 (63.4%) were <3cm in depth and only 13/145 (9%) were positive for PNI. 111/140 had final margins >5mm (78%), 15/140 margins 3-4mm (10.7%) and 10 patients had close margins 1-2mm (7%) and 4 (2.9%) true positive margins.

52/145 cases had SND (36%) 46 >3mm. Eleven of 46 were diagnosed with depth > than 3mm post-WLE and had delayed SND (24%). 8 cases >3mm had been excluded from this series as SND revealed +ve nodes. So in total there were 8 of 54 cases >3mm with occult nodes (15.4%) initially

Conclusion: Tongue cancer is increasingly being diagnosed early as Stage I In females without risk factors of smoking and associated with leukoplakia. More than half are <1cm with superficial infiltration. Almost 90% had adequate margins and <20% of cases with lesions <3mm that had SND had occult nodes. Clinical exam and biopsy could only accurately predict depth in 76% of cases.

LONG TERM OUTCOMES OF STAGE 1 ORAL TONGUE CANCER IN 115 PATIENTS

Authors: Ord RA, Lubek J, Dyalram D

Presenter: Robert A. Ord, DDS, MD

Purpose: to review long term outcomes of patients treated surgically for Stage I oral tongue cancer

Materials and Methods:- 145 patients with pathologic Stage I cancer of the oral tongue treated by surgical excision with SND for tumors with >3mm depth were followed to assess disease free survival and overall survival. 30 patients were excluded with follow up < 36months. 4 patients who DOD <36 months were included and 111 patients followed > 36 months average 79.5 months range 36-158 months.

Results: 4 patients DOD <36 months to give 3 year OS and DSS 111/115 (96.7%) During follow up 5 more patients died (average time to death of 90.4 months) with long term OS for the cohort of 92%. All 9 patients died with regional disease, the 4 early deaths all failed initially in the neck, the case dying at 38 months had initial loco-regional disease but the 4 long term failures initially failed locally.

Local recurrence occurred in 25 cases (21.7%) all were T1 or CIS, but only 14 were salvaged by surgery. 11 patients suffered multiple local and regional failures as well as second primary SCC with 4 dying of disease. Average time to first LR was 59.8 months and 16/25 60% failed initially >60 months.

5 patients failed initially in the neck 4 DOD, and 1 patient with LR failure DOD. 7 patients failed with second primary cancers 6 with second oral primaries.

A total of 38 patients failed initial surgery 33% giving a DFS of 66%.

Conclusion: Long-term follow up is mandatory in Stage I oral tongue SCC as one third of patients will fail initial surgery many at >60 months with 44% of deaths occurring at 95 - 123 months.

NEUTRON RADIOTHERAPY: ORAL COMPLICATIONS, LOCOREGIONAL CONTROL AND SURVIVAL RATE OF SALIVARY GLAND MALIGNANCIES

Authors: M. Timoshchuk, P. Dekker, C. Davis, DMD, G. Laramore, MD, PhD, and J. Dillon, DDS, MBBS

Presenter: Preston Dekker

Purpose: Primary and adjuvant radiation therapy is used to treat salivary gland malignancies. While there is abundant research concerning conventional photon radiotherapy, there is limited literature regarding oral complications following neutron radiotherapy (NRT). A previous study conducted by the University of Washington reviewed oral complications of NRT for salivary gland malignancies.¹ However, this previous study did not analyze malignancies in the parotid gland or base of tongue. The purposes of the study were to: 1) estimate the 6-year locoregional control and survival rates, 2) identify factors associated with locoregional control and survival and 3) measure the frequency of oral complications from NRT for all head and neck salivary gland malignancies.

Materials and Methods: The investigators implemented a retrospective cohort study and enrolled a sample composed of patients with salivary gland malignancies treated with NRT by the Radiation Oncology Department at the University of Washington between 1997 to 2010. Patients with inadequate medical records, history of radiation treatment to the head and neck, and any other head and neck malignancies were excluded. Study variables included patient demographics, tumor staging, characteristics, operative and pathological findings, surgical margins, dosing, oral complications, perineural, lymphatic, and base of skull involvement. The primary outcome variables were 6-year locoregional control, 6-year survival and quality-of-life measures abstracted from a survey evaluating the oral clinical outcome variables after NRT. Univariate, Kaplan-Meier, and Cox statistics were computed. Statistical significance was set at $p \leq 0.05$ to measure the association between the prognostic variables of interest and percent survival.

Results: The sample was composed of 558 subjects with a mean age of 54.2 (± 16) years and 48% were male. Adenoid cystic carcinoma (47%) and parotid gland location (56%) predominated. The 6-year locoregional control rate was 73% and 6-year survival rate was 72%. Survival was associated with positive surgical margins ($p < 0.0001$), lymphatic invasion ($p < 0.0001$), perineural invasion ($p = 0.024$), neck involvement ($p = 0.002$). Base of skull involvement ($p = 0.406$) was not significant. The quality-of-life survey indicated that mucositis and xerostomia occurred in approximately 89% and 79% of patients, respectively. 57% of subjects experienced trismus and 32% experienced an increase in tooth decay after NRT treatment. Osteoradionecrosis (ORN) occurred in 3% of patients.

Conclusion: This study further affirms that treating salivary gland malignancies with NRT is acceptable with our results showing that locoregional control compares favorably to that reported in the literature for conventional photon radiotherapy of the same areas. The frequency of oral complications and ORN was comparable to conventional photon radiotherapy (4-7%). Positive surgical margins and lymphatic invasion were significant prognostic risk factors associated with decreased percent survival. NRT is the preferable adjuvant treatment modality for head and neck salivary gland malignancies.

This study is the largest study to date assessing the oral side effects and osteoradionecrosis rates (3%) for NRT treatment. Health care professionals should be educated regarding NRT indications and oral complications.

References:

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ANTI-OX-40 (MEDI6469) PRIOR TO DEFINITIVE SURGICAL RESECTION IN PATIENTS WITH HEAD AND NECK SQUAMOUS CELL CARCINOMA: PRELIMINARY RESULTS FROM PHASE1B TRIAL

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Presenter: Arshad Kaleem MD, DMD

Background: Cancer immunotherapy is an evolving treatment that boosts the immune system to recognize and destroy cancer cells. Head and neck squamous cell carcinomas (HNSCC) produce suppressive factors that impair the immune system, thus limiting effective antitumor immunity. OX40 is a member of the tumor necrosis factor (TNF) receptor family and a potent co-stimulatory pathway that when triggered can enhance T-cell memory, proliferation and anti-tumor activity in patients with metastatic cancer.

Objectives: To determine the safety and immunologic activity of anti-OX40 treatment administered prior to definitive surgical resection in patients with locoregionally advanced HNSCC.

Methods: This is a phase Ib clinical trial using a murine antibody to OX40 (MEDI6469) at various dose intervals prior to definitive surgical resection of patients with HNSCC. The interval between MEDI6469 doses and resection will allow for determination of the effect of MEDI6469 on the tumor infiltrating lymphocyte (TIL) composition over time and will ensure patient safety in administering MEDI6469 preoperatively. After the time-course portion of the trial, an expansion cohort of up to 35 additional patients will be enrolled at the safe pre-operative dosing interval found to have the most promising immune response measured in peripheral blood and within tumors. The primary endpoint is safety. In addition, tumor tissues and peripheral blood are being obtained for exploratory immunologic end points including measurements of tumor infiltrating immune cell populations based on flow cytometry, multispectral imaging, immunohistochemistry, as well as other circulating immunological parameters that may correlate with changes induced by MEDI6469 administration. Enrollment is ongoing. Clinical trial information: NCT02274155

Results: The time course portion of the trial has completed enrollment. MEDI6469 administration was well tolerated and there were no grade 3 or 4 adverse events related anti-OX40 treatment. The toxicity profile was mild, most commonly consisting of low-grade fever prior to surgery. Immunologic changes have been observed at all time courses with significant proliferation of CD4+ and CD8+ central and effector memory T-cell populations in both the tumor microenvironment and circulation occurring between 12 and 19 days following MEDI6469 infusion. Ki67 is specifically induced on peripheral blood PBMC's and in the TME after MEDI6469 administration, returning to baseline at Day 55. CD39 is induced on the CD4+ cells in almost all subjects and CD39/103+ cells are increased in a subset of subjects. Enrollment in the expansion cohort is ongoing.

Conclusion: Preoperative MEDI6469 administration prior to surgery is feasible in patients with HNSCC and results in proliferation of T cell populations that peak between 12 and 19 days following infusion.

SENTINEL LYMPH NODE BIOPSY IN CLINICALLY N0, T1/T2, ORAL SQUAMOUS CELL CARCINOMA

Authors: Arshad Kaleem MD, DMD, Eric Dierks, MD, DMD, FACS, Allen Cheng, MD, DMD, Ashish Patel, MD, DDS, R.Bryan Bell MD, DDS FACS

Presenter: Arshad Kaleem MD, DMD

Purpose: The purpose of this study was to evaluate the use of sentinel lymph node biopsy (SLNB) to correctly identify the presence or absence of nodal metastasis and to determine the outcomes of SLNB alone as the staging procedure in patients with clinically N0 oral squamous cell carcinoma.

Method: Fifty-nine patients who had T1/T2N0 oral squamous cell carcinoma (OSCC) were included in this study. All patients had the neck clinically staged by clinical exam and computed tomography. Patients with recurrence, history of radiation or chemotherapy were excluded from the study. Preoperative lymphoscintigraphy was performed after injecting the lesion with 99mTc-sulfur colloid and the sentinel lymph node(s) was identified with a hand held gamma probe. For the purpose of this study, patients were divided in two cohorts: Cohort A (N=38), SLNB with concurrent selective neck dissection clearing at least level I-III (SND); and Cohort B (N=21), SLNB alone. Main outcomes were sensitivity and negative predictive value of SLNB. Patients in Cohort B (21/59) who had negative results on SLNB were treated without neck dissection. These patients were observed clinically for recurrence rates, and disease-specific survival.

Result: Sentinel lymph nodes were successfully detected in all patients. In Cohort A (SLNB+ SND), of the thirty patients who had negative SLNBs, twenty-nine were found to have no positive nodes in the SND specimen, yielding a negative predictive value (NPV) of 96.7%, and specificity of 100%. In thirty-seven patients in Cohort A, SLNB correctly identified the status of the neck, with only one patient having a negative SLNB but a positive neck on SND, yielding a sensitivity of 88.9 %. Eight out of thirty-eight patients had positive nodes on both SLNB and SND with positive predictive value (PPV) of 100%. Three of these patients had additional positive nodes on the ND specimen. Five out of eight patients with positive nodes had T2 lesions the rest had T1 lesion. In cohort B (SLNB alone), twenty patients had negative sentinel nodes and did not undergo concurrent selective neck dissection, and one patient had metastatic disease a single sentinel lymph node, and subsequently underwent SND. The mean follows up was 2.83 years, with maximum of 5.27 years. So far there has been zero recurrence in this group

Conclusion: SLNB may accurately predict the status of the neck in clinically N0 necks of patients with early stage SCC of oral cavity.

DOES PERINEURAL INVASION, A NEGATIVE PREDICTOR OF OUTCOME IN ORAL SQUAMOUS CELL CARCINOMA, HAVE SITE-SPECIFIC CORRELATION?

Authors: Roderick Youngdo Kim DDS MD; Joseph I Helman DMD; Thomas M Braun PhD; Brent B Ward DDS MD

Presenter: Roderick Youngdo Kim, DDS, MD

Purpose: Despite data showing worse outcomes and aggressive disease behavior,^{1,2} perineural invasion (PNI) has not been well correlated with tumor location, size, or other prognostic features. Our study aimed to identify if such correlations exist.

Material and Methods: The study was a retrospective review from tertiary-referral health system. Adult patients with primary squamous cell carcinoma of the oral cavity who underwent neck dissections were included. We excluded patients whose neck was previously treated with surgery or radiation. Three hundred and seventy-three patients met the criteria and items of interest were obtained from the standard pathology report. Statistical significance for the study was set at a p-value less than 0.05.

Results: Perineural invasion showed statistically significant correlations with tumor size, lymph node status, and specific primary tumor location. Tumors with PNI had relatively larger overall size, 3.37 ± 1.79 cm versus 2.39 ± 1.70 cm ($p < 0.001$). Tumors with PNI had deeper depth of invasion 1.58 ± 1.08 cm versus 1.02 ± 1.00 cm ($p < 0.001$).

Tumors with perineural invasion had higher mean total number of positive nodes, 2.88 ± 5.21 versus 0.83 ± 1.80 ($p < 0.001$). Patients with any lymph node positivity had higher chance having perineural invasion at 58% versus lymph node negative patients at 32% ($p < 0.001$).

Lastly, in terms of location, perineural invasion was more likely seen in tumors located at the tongue or floor of the mouth. This finding was not significant in a univariate analysis ($p = 0.261$), but was significant after adjustment for other patient characteristics in a multivariate logistic regression model ($p < 0.05$).

Conclusions: Perineural invasion is statistically correlated with tongue and floor of the mouth subsites within the oral cavity as well as, larger tumors, deeper tumors, and disease, which has progressed to the lymph nodes.

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BONE INVASION BY ORAL SQUAMOUS CELL CARCINOMA: ESSENTIAL MOLECULAR ALTERATIONS**Authors:** L.A.A. Vaassen, E.J.M. Speel, P.A.W.H. Kessler**Presenter:** Laretta Vaassen, MD, DMD

Abstract: Squamous cell carcinoma of the oral cavity (OSCC) is a globally growing problem with 300,000 new cases each year. The close anatomical relation of the oral mucosa to the jaws often leads to invasion of the bone, implicating extensive resections with major implications on function, esthetics and quality of life. Planning of bony resections depends on two staging methods: 1) clinical estimation by the surgeon and 2) radiological imaging. Unfortunately both methods have their shortcomings. Most important step in bone invasion is activation of osteoclasts. A better understanding on molecular alterations leading to this osteoclastogenesis is of great importance. The oral cavity is an environment with specific environmental circumstances: the presence of teeth and chronic infections around the tumor microenvironment could have a key role. We propose that reprogramming energy metabolism (hypoxia) and tumor promoting inflammation also play an important role in bone invasion by OSCC. Goal of our research is detecting molecular biomarkers associated with bone invasion by OSCC. Improvement in the understanding of these molecular processes will lead to a better staging protocol and a more tailor-made treatment for the patient. On this topic we did a review of literature. We will propose a hypothesis that might lead to a better understanding of OSCC invading bone.

INTRAOSSIOUS SQUAMOUS PROLIFERATION VS. CARCINOMATOUS TRANSFORMATION OF CHRONIC OSTEOMYELITIS OF THE MANDIBLE

Authors: Samir Waris, DMD, MD; Kevin Arce, DMD, MD; Marvin Vallejo, DMD; David Schembri-Wismayer, MD

Presenter: Samir Waris, DMD, MD

Purpose: Osteomyelitis is one of the oldest described diseases, dating back to the time of Hippocrates. The term osteomyelitis was first used by Nélaton in 1844. It can occur as a result of hematogenous seeding, local spread of infection from an adjacent site or direct inoculation due to trauma or surgery. Squamous epithelium proliferation secondary to inflammation and infection in osteomyelitis of the long bones has been described. This represents a diagnostic challenge when determining whether this is a reactive squamous proliferation or carcinomatous transformation of chronic osteomyelitis. The purpose of this presentation is to report two cases of intraosseous squamous hyperplasia arising in mandibular osteomyelitis.

Materials and Methods: A medical record review of patients treated for osteomyelitis of the jaws by the Division of Oral and Maxillofacial Surgery at the Mayo Clinic, Rochester was performed.

Results: Two patients were identified. A 65 year old female and a 56 year old male were referred for treatment of refractory chronic, non-suppurative osteomyelitis of the mandible. Each patient had a dental extraction prior to disease development and had undergone debridement and intravenous systemic antibiotic therapy prior to referral. Both patients had a pathologic fracture on initial presentation and required a segmental mandibulectomy and reconstruction with a free fibula flap followed by intravenous antibiotic therapy. One patient completed mandibular prosthetic rehabilitation and developed recurrence of osteomyelitis in the neomandible and subsequent pathologic fracture in a 2 year span. Histological evaluation of the specimens for both patients revealed intraosseous squamous proliferation vs. well-differentiated squamous cell carcinoma.

Conclusions: Squamous proliferation in osteomyelitis has been termed pseudocarcinomatous hyperplasia, pseudoepitheliomatous hyperplasia, invasive acanthosis, verrucoid epidermal hyperplasia, and carcinomatoid hyperplasia[1, 2]. As the different terms suggest, this squamous proliferation has a histological resemblance to a well-differentiated, oral cavity squamous cell carcinoma with mandibular invasion or a carcinomatous transformation of chronic osteomyelitis. This can represent a diagnostic challenge in the management of patients with this finding when trying to determine the need or type of further treatment and disease surveillance that should be performed.

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