Oral Health-related Quality of Life in Teens Requiring Orthodontic Treatment

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Objectives: This project examines the association of malocclusion and orthodontic treatment need on the quality of life as measured by the Teen Oral health related Quality of Life instrument (TOQL). **Methods:** This study surveyed teens between the age of 10 to 18 who are receiving care at BUGSDM orthodontic clinic and their parents. Teens with grade 2 or greater Index of Orthodontic Treatment Need (IOTN), as determined by their provider, were included in the study. Higher IOTN rating (4 or 5) means the subject requires more orthodontic treatment compared to lower ratings (2 or 3). Patients with mental or physical disabilities, or patients with previous orthodontic treatment, were excluded from the study. **Results:** Baseline data were available on 69 subjects, mean age was 13.09 years, 50.7% were female and 64.2% had Medicaid. Thirty-one subjects had IOTN 2 or 3 and 38 subjects had IOTN 4 or 5. IOTN 4 or 5 subjects scored higher (worse) on the overall 17-item TOQL questionnaire. IOTN 4 or 5 subjects also scored significantly higher ($p=0.0005$) on the esthetic component compared to those with IOTN 2 or 3. Subjects receiving orthodontic treatment scored higher than a comparison group (subjects from a general population) on the 9 items of the TOQL questionnaire. Subjects in the orthodontic group scored significantly higher (worse) on the social domain of the TOQL ($p=0.0136$) and were more likely to be unhappy with their looks ($p=0.0049$), feel angry ($p=0.0247$), worry they were less attractive ($p=0.0383$) and not want to smile ($p=0.031$) compared with children from the comparison group. **Conclusion:** Teens requiring orthodontic treatment are negatively affected both socially and emotionally by their malocclusion. The findings support the use of the TOQL questionnaire as a valid instrument to assess these subjects. Supported by NIH/NIDCR K24 DE18211 Grant.

Self-Reported Oral Health of Smokers and Their Children

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Objectives: Smoking is a significant risk factor for poor oral health. According to the National Center for Health Statistics, current smokers are four times more likely than never smokers to have poor oral health (Oral Health, U.S. 2002 Annual Report). The current study examines the association between parental smoking and their self-reported oral health and parents' reports on oral and general health of their teenaged children. The impact of oral health on the daily functioning of teens before orthodontic treatment is assessed utilizing the Teen Oral Health-related Quality of Life survey. **Methods:** This is a cross-sectional study of teens' and parents' perception of the impact of teens' teeth and mouth on the teen's oral specific health-related quality of life. Parents report on their past and current smoking status, their oral health and the general and oral health of their teen. Chi square and general linear models evaluate the association between smoking status and oral and general health. **Results:** Baseline responses of 68 parents and their teenaged children (mean age = 13.1) are examined. Of the parents, 6 were current smokers, 11 former smokers and 51 never smoked. One quarter (23.5%) of the parents reported their Oral Health to be either Fair or Poor; 66.7% of current, 27.3% of former and 17.7% of never smokers reported their oral health to be Fair or Poor. Parent smoking status was not related to teen self reports on oral or general health. **Conclusion:** Parent smoking status is related to parents' self-reported oral health but not that of their teens. Supported by NIH/NIDCR K24 DE18211 Grant.

Impact of Platelets on Neutrophil Function

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Objectives: In response to infection or injury, there is an increase in the number of platelets and neutrophils released from bone marrow into the circulation, which regulates inflammation. An acute inflammatory lesion can resolve normally with return to homeostasis or become chronic. Activation of platelets at sites of infection or injury leads to the release of considerable quantities of potent endogenous bioactive substances; the interaction of platelets and neutrophils is a necessary step in production of lipoxins and resolution of inflammation. The aim of this study was to study the impact of platelets on neutrophil function. **Methods:** Neutrophils and platelets were isolated from peripheral blood from healthy patients (n=6) by differential centrifugation. Different ratios of platelets and neutrophils were prepared and incubated for 1 hour at 37°C, and then stained with Giemsa to identify neutrophils. Superoxide production by neutrophils was quantified with and without fMLP stimulation using a colorimetric assay. Platelet activation was determined by CD41a labeling with PE-Cy5 and analyzed by flow cytometry. **Results:** When the neutrophils were co-incubated with the platelets, low platelet-to-neutrophil ratios (0.01-0.1) stimulated superoxide production by neutrophils ($p<0.05$). Increased platelet ratios (1-10) reduced or completely blocked superoxide generation by neutrophils ($p<0.05$). At 2.5:1, neutrophil aggregation increased significantly from low platelet-to-neutrophil ratios (0.01-0.1) at 5:1 and 10:1 ($p<0.05$). Measurement of PE-Cy5 binding by FACS revealed that interaction with neutrophils increased platelet activation more than 2-fold ($p<0.05$). **Conclusion:** The data suggest that platelets play a key role in the inflammatory response decreasing free radical formation in platelet- neutrophil aggregates preventing tissue damage. Neutrophils enhance platelet activation initiating co-aggregation.

Pantomographic Evidence of Endodontic Treatment and 15-year Cardiovascular Mortality

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Objectives: Inflammation from pulpitis has been implicated with increased risk of future cardiovascular disease (CVD), thus removing pulpal inflammation by endodontic treatment (endoTx) is postulated to improve CVD survival. We, therefore, sought to investigate the relationship of pantomographic evidence of endoTx and CVD mortality. **Methods:** Kuopio Oral Health and Heart study was initiated as a case-control investigation (256 CAD cases and 250 controls, mean age=61) in 1995. We appended mortality status to the baseline data and formulated this 15-year longitudinal study where causality may be presumed. The relationship of pantomographic evidence of endoTx on cardiovascular mortality was examined by proportional hazard regression analyses adjusting for age, sex and smoking, diabetes, hypertension, total/HDL cholesterol ratio and education. EndoTx being dependent on the number of teeth (numbT), we adjusted for the numbT in addition to confounding adjusted above. We further conducted subgroup analyses stratified by (1) Coronary Artery Disease (CAD) status or (2) dentate status. **Results:** In a fully adjusted multivariate model, those who received 1≤ endoTx demonstrated significantly improved CVD survival by 67% compared with those who did not. The hazard ratio (HR) for CVD mortality associated with endoTx was 0.33 [95% confidence interval (CI): 0.14 - 0.75] and P-value was 0.009. With additional adjustment for numbT, endoTx was still protective against cardiovascular mortality with HR 0.45 (0.22 - 0.93), P-value 0.03. Subgroups who had CAD at baseline or the group excluding edentulous persons also demonstrated beneficial trends of endoTx with HR =0.48 (0.18 - 1.30), p-value=0.15 and HR 0.48 (0.22 - 1.03) p= 0.06, respectively. **Conclusion:** In this age 60 and older population, endodontic treatment at baseline significantly improved cardiovascular survival by 67% after a 15- year follow-up. Even those who had CAD at baseline appeared to benefit by endodontic treatment in CVD survival, by a non-significant 55%. Future larger studies are warranted.

Parents and Teens Agree on Malocclusion's Quality of Life Impact

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Quality of Life (QoL) measurements have been underutilized in the field of dentistry because traditional focus was on the treatment of oral disease. **Objectives:** This study aims to assess the construct validity and level of agreement of the PedsQL and Teen Oral Health-related Quality of Life (TOQL) in teens with malocclusion from the parents and patients' perspectives. It also examines the association of treatment need with the orthodontic patients' scores. **Methods:** This study examines baseline data from a longitudinal study. Teens and school age patients age 10-18 (N=69, mean age=13.09) who presented to the BUGSDM Orthodontic clinic for treatment and were categorized as grade 2 or greater in the Dental Component (DC) of the IOTN (Index of Orthodontic Treatment Need-Burden, 2001) were eligible for inclusion. PedsQL (Varni, 1999), TOQL (Wright 2011), and Esthetic Component of IOTN were filled out before treatment by the patient and parent/guardian. **Results:** There was moderate agreement (Kappa=.513) on the aesthetic component of IOTN between parents (mean =4.32) and teen's (mean=4.43). For PedsQL, there was a significant difference in Child Self Report and Parent Report on Child in the 'Physical Health Summary Score' (p=.0008), 'Social Functioning Score' (p=.0032), and 'Total PedsQL' (p=.0086), with parents reporting lower quality of life than children. All domains of TOQL were not significantly different. There were significant differences (p<.05) between parents and teens on impact items that assess pain, sleep, food impaction, and mouth sores. **Conclusion:** Parents and teens show agreement in 13 out of 17 (76%) of the 'Impact' scores of TOQL. Disagreements were seen in values which the parent may not see the effect on the child's QoL (pain, trouble sleeping, food between teeth, and mouth sores). The dental-specific TOQL has higher construct validity than PedsQL for parent reports on child's oral health quality of life. Supported by NIH/NIDCR K24 DE18211 Grant.

Effects of Orthodontic Mimicking Mechanical Stress on Stem Cells

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Objectives: Skeletal tissues use mechanotransduction to convert mechanical forces into biochemical signals, which is important for maintaining bone health and homeostasis. Current orthodontic procedures depend on skeletal tissue's ability to respond to mechanical forces. The objective of this study is to explore whether primary cilia are essential for the responses of mesenchymal stem cells (MSCs), precursor cells of osteoblasts and chondrocytes, to mechanical signals. **Methods:** As the control gel (no force), mouse mesenchymal stem cells (MSCs) were seeded in a fibrinogen/ thrombin gel matrix that was released from the culture dish and incubated with complete culture medium. Force gels were created similarly with the addition of two sutures pinned onto the dish 1cm apart. After 10 days of culture, gels were embedded in paraffin and sections were stained with hematoxylin and eosin (H & E), acetylated tubulin (ciliary marker) and Rhodamine-conjugated Phalloidin (F-actin marker). Slides were evaluated using confocal and episcopic microscopy. **Results:** The force gel started to form a linear construct between the two pinned sutures after 5 days of culture, exhibiting significantly different morphology than the control gels. H & E and F-actin staining of force gel cells revealed long extensions along the same direction as the applied mechanical stress, while the control gel cells remained round without organized extracellular fibrils. Acetylated tubulin immunostaining labeled primary cilia as a single structure extended from the cells, along the same direction as the mechanical stress in the force gel cells. Lengthier primary cilium was found on MSCs subjected to mechanical stress compared to control gel cells. **Conclusion:** The results support the hypothesis that the modulation of ciliary length and orientation is involved in the cellular responses to mechanical stress. 3D culture of MSCs is a useful model to study molecular mechanisms of mechanotransduction. Supported by research fund from BUGSDM and AAOF.

Characterization of Wdr72 Knockout Rats, Causative Gene for Amelogenesis Imperfecta

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Amelogenesis imperfecta (AI) is a group of inherited tooth development disorders in which the patients suffer from dental problems with poorly formed enamel. Recently, a new hypomaturation type of AI has been found with mutations in WDR72 (WDR72-AI). The potential pathological mechanism as to how the mutation of WDR72 leads to the AI condition may be unique, because WDR72 encodes for an intra-cellular protein, suggesting the presence of intracellular signaling pathway required for enamel formation/biomineralization. **Objectives:** As a preliminary step towards the delineation of WDR72 biological function in WDR72-AI, the purpose of the present study was to establish the animal model of WDR72-AI and characterize the tooth phenotypes. **Methods:** The knockout (KO) rat model with Wdr72 mutation was established and the gene deletion was confirmed by PCR methods. The expression of Wdr72 in various tissues was investigated by real-time qPCR. The dental phenotypes of homozygous Wdr72 KO rats were morphologically and histologically compared with those of wild-type and heterozygous Wdr72 KO rats (controls). **Results:** Each genotype of Wdr72 KO rats was successfully identified. The expression of Wdr72 was detected in tooth and its expression pattern was associated with tissues where epitherial-mesenchymal interaction occurs such as kidney and tooth. All teeth in homozygous KO rats showed defective enamel morphology compared to those in the controls. The radiographical analysis demonstrated that the severe attrition was found in KO rats. Histological analysis demonstrated the abnormal tooth structures in KO rats. **Conclusion:** The Wdr72 KO rats exhibited the dental phenotypes characteristic of the AI patients. This unique model will offer a valuable research tool to further understand the pathophysiological molecular functions of WDR72 in enamel formation/biomineralization. Supported by NIH/NIDCR DE019527.

Effect of Oral Health Promotion Provided by Public Health Nurses on the Behaviors of Mothers with Infants

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The Boston Public Health Commission's Healthy Baby/Healthy Child Program (HBHC) is a perinatal home-visiting program that targets women at high risk for adverse birth outcomes. **Objectives:** The purpose of this study was to explore the feasibility of incorporating a patient-centered oral health promotion model, delivered by home-visiting nurses, into HBHC and to assess the program's impact on participant's risk factors for early childhood caries (ECC). **Methods:** All nurses were trained in patient-centered counseling and oral health. For participating families, nurses incorporated oral health visits into their home visiting schedule. After each visit a dental hygienist conducted a follow-up oral health assessment and administered a questionnaire. Data was obtained from 18 mother-child controls and from 37 mother-child pairs who received home-based oral health counseling provided by the HBHC nurses. Chi-square tests and t-tests were performed. The participants were Black (59.5%), Hispanic (27.0%), Medicaid-eligible (70.3%), and 21.6% did not graduate high school. **Results:** The results indicated an increase in the percentage of mothers who reported wiping their child's gums or brushing their teeth (55.6% of controls; 86.5% at the first assessment; 100.0% at the third assessment; $p < 0.05$ for both) and in the percentage who reported that their child had a dentist (0.0% of controls; 35.1% at the third assessment; $p < 0.05$). **Conclusion:** These findings support the use of patient-centered counseling, provided by home visiting nurses, as an effective approach to prevent ECC among those most at risk and least likely to receive dental care. More research should be conducted in this promising area.

The Binding of Pure Salivary Proteins to Hydroxyapatite and Its Protective Effect Against Demineralization

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Introduction and Aims: Histatins, statherin and proline-rich proteins (PRPs) are important members of the human saliva proteome. They are components of the acquired enamel pellicle (AEP) which provides protection to the teeth and perform other vital functions in the oral cavity such as preventing spontaneous precipitation of calcium phosphate salts (statherin) and exhibiting fungicidal activity (histatins). The aims of the study were to (1) isolate histatins, statherin and acidic PRPs from parotid secretion, (2) develop a novel functional assay for the measurement of hydroxyapatite demineralization by modifying pre-existing methods and (3) test the binding of mixed PS proteins and purified salivary proteins (histatin 1, statherin and PRP1) to HA and the subsequent effect on demineralization. **Materials and Methods:** The steps in the histatin, statherin and PRP purification process include zinc precipitation of parotid saliva, ion exchange chromatography, gel filtration chromatography and high performance liquid chromatography (HPLC). Protein purity was assessed by polyacrylamide gel electrophoresis (PAGE). The functional properties of the proteins were examined in two ways: Binding of mixed and purified proteins to ceramic hydroxyapatite (HA) powder was monitored by PAGE and HPLC, and demineralization of HA exposed to acidic conditions after incubation with mixed and purified proteins was determined in spectrophotometric assays for free calcium ion and phosphate. **Results:** Histatins and PRPs were successfully isolated to high levels of purity from human parotid saliva (HPS). Salivary protein binding experiments showed that the order of the three proteins studied in terms of their apparent affinity for HA is: statherin > histatin 1 > PRP1. The linearized Langmuir adsorption plots for histatin 1 and statherin fit well, showing R2 values of 0.9880 and 0.9975, respectively. However, the adsorption isotherm for PRP1 did not exhibit linear characteristics (R2 value of 0.78). Functional assays performed to measure the release of calcium ion and phosphate showed variable levels of protection afforded to HA by preincubation with the three proteins. On a molar basis, histatin 1 provided the most protection against demineralization. **Conclusion:** The in vitro data generated add to a more complete understanding of the functional characteristics of histatins, statherin and PRP1 and thereby provide insights into their potential capacity to protect enamel in the oral environment. These studies were supported by NIH/NIDCR grants DE05672 and DE07652.

Using a Cone Beam CT Scan to Evaluate Periodontal Bone Height

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Bone level is assessed to ensure that there is sufficient bony support for orthodontic treatment. This is usually carried out on bitewing radiographs, which are small films exposed intraorally and include 2-3 teeth on each film. Many patients presenting for orthodontic treatment now have cone beam CT scans exposed as part of their workup. It is not known whether this scan can provide views accurate enough to substitute for bitewing radiographs. It would be beneficial for patients to use the CT scan if possible to avoid unnecessary radiation exposure. **Objectives:** The purpose of this study is to retrospectively compare assessments of bone level on CT scans with bitewing radiographs to determine the utility of cone beam scans in periodontal diagnosis. **Methods:** Patients who have both cone beam CT scans and bitewing radiographs taken within a 3-month period will be identified. Images including the same teeth from the same angle and magnification as the bitewings will be constructed from the cone beam scan. Both images will be presented separately to groups of judges, who will evaluate the images for interdental bone level using the SALUD measuring tool. Images from at least 50 patients will be used. Interclass correlations will be used to determine whether the assessments made on the CBCT scans are as accurate as those made from bitewing radiographs.

A Longitudinal Assessment of Dental Students' Knowledge about the Elderly

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Objectives: America's health care professions have started to struggle with providing care to increasing numbers of senior citizens/older adults. Proper care requires an understanding of these patients. This study aims to identify trends over the past four academic years regarding dental students' knowledge of and attitudes about aging Dental students from four consecutive academic years completed a validated survey to evaluate their current level of knowledge about aging. Advanced Standing (AS) students (foreign-trained dentists) and traditional Doctor of Dental Medicine (DMD) students both participated. The null hypothesis was that there would be no difference in performance between each academic year and that there would be no difference in performance between AS and DMD students. **Methods:** Both AS and DMD students from the four academic years of 2007-2008 participated in the study. The metric used to measure the students' knowledge was their score on the Palmore's Facts on Aging quiz. The quiz was completed anonymously prior to the first session of a course in Geriatrics and Gerontology. The quizzes were graded using scantron answer sheets. IRB approval for exempt status was obtained. **Results:** Results from the Facts on Aging Quizzes were compared using the Student t-test. The DMD students of the academic year 2010-2011 scored significantly higher than the DMD students from 2007-2008 and 2009-2010. The AS students of the academic year 2008-2009 scored significantly higher than the AS students of 2009-2010. The DMD students scored significantly higher than the AS students in each of the years evaluated. The small performance changes from year to year were shared by both DMD and AS students. **Conclusion:** It was expected that the scores would trend upwards from year to year as the public becomes more aware of the complexities of aging. The study finds that among AS and DMD dental students, there is significant difference between the classes regarding knowledge on aging, but a clear upward trend was not seen. It was also found that small increments reflected in knowledge metrics were mirrored in both the DMD and AS classes. It may be expected that the AS students would score higher than DMD students due to the more elder-centric foreign cultures, however the study confirms previous findings that DMD students score higher than AS students.

Parents Report Lower Quality of Life in Children with Malocculusion

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Parents play an integral role in the orthodontic treatment of their children. A previous study found that parents are a suitable alternative to their children in surveys measuring oral health-related quality of life (Bos, 2010). **Objectives:** Assess the validity of the PedsQL (Varni, 1999) and Teen Oral health-related Quality of Life (TOQL-Wright 2007) instruments in teens with and without malocclusion and the impact of treatment on orthodontic subjects' scores from the parents' perspective. This study examines if the need for orthodontic treatment and severity of malocclusion are associated with scores on the TOQL and PedsQL, and if the magnitude of this association is stronger for the oral-specific instruments, the TOQL than the generic PedsQL. **Methods:** Baseline data on 86 parents of orthodontic clinic patients (Mean age=13.16±1.88) evaluated whether TOQL and PedsQL scores varied based on severity of orthodontic treatment need (Index of Orthodontic Treatment Need [IOTN-Kok 2004] scores of 2/3 versus 4/5 [worse]). A second analysis compared the parents of orthodontic patients to a comparison group of parents of caries-free teens from previous studies who were age- (±2) and sex-matched to the study population (N=172, Mean age=13.07±1.89). The data were analyzed using SAS®, version 9.2. **Results:** Parents with teens having worse scores on the IOTN (4/5) reported higher scores (worse) on the overall 17-item TOQL, as well as the social and oral problems domains than those with IOTN scores of 2/3 ($p<0.05$). The parent-reported scores of the orthodontic subjects on the overall 9-item TOQL as well as the role, social, and emotional domains were significantly worse than those of the comparison group ($p<0.01$). This was not the case for the generic PedsQL. **Conclusion:** Malocclusion, in general, and severity of malocclusion were found to be more likely associated with the TOQL than with the PedsQL. Supported by NIH/NIDCR K24 DE18211 Grant.

Impact of Clinically Used Alendronate (Fosamax) on Novel Three-Dimensional Cancer-Bone Metastasis Model Systems Using Co-cultures of Live Mouse Calvarial Bone Organs and Tumor Cells

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Introduction: Bisphosphonates have been used as anti-resorption drugs in treatment of osteoporosis and cancer-bone metastasis. However, the impact of these drugs on the integrity of bone cells has not been clearly understood as highlighted by the adverse effects such as development of osteonecrosis of jaw bone. We have developed and utilized novel “three-dimensional cancer-bone metastasis model” system using ex-vivo co-cultures of live mouse calvarial bones and cancer cells (Curtin, Youm, and Salih, 2012, Biomaterials, 33:1065-1078). These model systems under defined conditions simulate closely the in vivo live bone microenvironment in response to cancer-bone interactions. Hence, permit studies to be carried out towards understanding the underlining molecular and cellular mechanisms including development of novel drug targets. Study Aims: To determine the impact of clinically used anti-resorption drug alendronate on bone cells and the capacity of bone to regenerate. **Materials and Methods:** To test the effects of alendronate on the integrity of bone cells Co-cultures of live mouse neonatal calvarial bone and cancer cells, PC3 and MDA-231 prostate and breast cancer cells, respectively, in a roller tube model system were used in the absence and presence of alendronate. These models were used under conditions whereby the two naturally occurring bone remodeling stages were dissociated, viz., bone resorption and formation. The used media and calvarial bones were evaluated by chemical, biochemical, histological and quantitative histomorphometric analyses. **Results:** These studies revealed that under resorption conditions PC3 and MDA-231 cancer cells induce differentiation of osteoclasts and bone resorption and inclusion of alendronate inhibited cancer-induced bone resorption. However, alendronate treated bones were adversely impacted as demonstrated by their inability to respond to stimulation for new bone formation. These data indicated that the bone stem/progenitor cells appeared non-vital. Similarly, in the formation model system the new bone formation was also limited.

Basal and Dental Arch Changes of Class I, II Malocclusions

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Background: Super-elastic wire material, pre-adjusted appliance systems, and preformed arch wires have been more frequently used for leveling and alignment. Mismatched pre- to post-treatment arch form and dimensions result in a higher tendency and probability for relapse. Aim: To investigate the basal and dental arch changes of the Angle Class I and II malocclusions in skeletal class I patients during treatment. **Material and Methods:** The sample included 70 patients with Angle class I or class II malocclusion treated by Boston University residents. Pretreatment and posttreatment models were scanned using a three-dimensional laser scanner. Cast analyzing software was used to combine images of the mandibular dental casts, which are scanned at 3 angles in the frontal and sagittal planes. Using Meshlab™, the anatomic reference points FA points and WALA points were identified to represent the dental and basal arch dimension respectively. Comparison of the mandibular inter-canine (IC) and inter-molar width (IM) for all groups was performed with Paired and independent samples t-tests. **Results:** We found that on average there is no statistical significant difference between the pretreatment intercanine and inter-molar widths in class I and class II patients using either the FA or WALA points ($P>0.05$). When we compared pre- to post-treatment in patients with class I malocclusion there were statistically significant differences in (IC), and (IM) using both the FA and WALA points ($P<0.05$). On the other hand comparing pre and post of class II patients there was no statistically significant difference at the (IC), or the (IM) ($P>0.05$) except for the (IC) using the WALA point ($P<0.02$). **Conclusion:** Arch dimensions are not maintained during treatment of class I subjects using pre-adjusted appliances and preformed arch wires. Careful attention is needed during treatment of class I cases to maintain arch dimension and aid in more stable occlusion.

Immunohistochemical Investigation of TGF-beta Expression in Gingival Tissue of Phenytoin Treated Mice

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Patients undergoing phenytoin treatment may develop gingival overgrowth as a side effect. During this drug-induced gingival overgrowth (DIGO), epithelial tissues will go through epithelial to mesenchymal transition (EMT) to become more like connective tissue. EMT is associated with fibrosis as well as cancer. Objectives: The objective of this experiment is to investigate TGF-beta expression in anterior and posterior gingival epithelial and connective tissues of phenytoin treated mice in order to confirm the correlation between TGF-beta expression and gingival overgrowth in mice. The hypothesis is that since the gingival overgrowth happens extensively in the anterior gingival tissues, TGF-beta expression will be noticed extensively in the anterior gingival tissues. This study is a part of a larger project to replicate phenytoin-induced gingival overgrowth in a mouse model in order to study and find new treatments for the gingival overgrowth. Methods: 8 Week old mice were divided into a phenytoin injected group (sample=6, treated with 0.6mg/day/20 g mouse for 10 weeks) and a control group (control=4 mice, treated with 0.9% NaCl for 10 weeks). At week 12, the jaws were processed for histology. Then, immunohistochemical analyses were done in order to assess TGF-beta expression in gingival epithelial and connective tissues. Results: By comparing the anterior gingival tissue of the phenytoin-treated mice to that of the control mice, one can notice that both have dark brown staining in the epithelial tissues. However, one can only find staining in connective tissues of phenytoin-treated mice, but not in control mice. In the posterior gingival tissue of the phenytoin-treated mice, one can notice some staining mostly in the epithelial tissue and some light brown staining in the connective tissue. The experiment of the posterior gingival tissue of control group should be performed in order to compare it to the posterior gingival tissue of phenytoin-treated group. Conclusion: TGF-beta expression is definitely noticeable in the phenytoin-treated group's epithelial and connective tissues of anterior gingival tissue whereas it is only found in the epithelial tissues of control group's anterior gingival tissue. TGF-beta expression is noticeable in phenytoin-treated group's epithelial tissues and lightly noticeable in some connective tissues of posterior gingival tissue. The experiment of the posterior gingival tissue of control group should be performed in order to compare it to the posterior gingival tissue of phenytoin-treated group. Also, further study of quantitative analysis should be performed and the study of other EMT contributing factors is in progress in order to complete the total project of replicating human gingival overgrowth in mouse model and finding the cure for the gingival overgrowth. Supported by R01 DE11004 and R01 DE14066 grants.

Effects of Phosvitin on Cancer-Bone Interactions Evaluated Using Co-cultures of Live Mouse Calvarial Bone Organs and Tumor Cells

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Introduction: We have developed a novel “there-dimensional cancer-bone metastasis model” using ex-vivo co-cultures of live mouse calvarial bones and cancer cells (Curtin, Youm, and Salih, 2012, Biomaterials, 33:1065-1078). These model systems were found to be very conducive to testing new drugs/agents as well as studies targeted to the mechanism of bone cancer-interactions. We have hypothesized that cancer cells utilize specific bone remodeling stages for homing and colonizing bone microenvironment. Our discovery that phosvitin facilitates new bone formation led us to postulate that this phosphoprotein can interfere with the cancer-bone interactions. **Study Aims**: To determine the effects of egg yolk phosvitin on the mechanism of cancer-bone metastasis using our co-culture model systems under conditions whereby the two naturally occurring bone remodeling stages are dissociated, viz., bone resorption and formation. Materials and Methods: To test effects of phosvitin on cancer-bone interactions we have co-cultured live mouse calvarial bones and PC3 prostate cancer cells in the absence and presence of added phosvitin in a roller-tube model system. These studies were carried out under: (a) bone resorption and (b) bone formation conditions using co-cultures of calvarial bones and PC3 cells in the absence and presence of phosvitin for 10 days with changes of media every 2 days. The used media and calvarial bones were evaluated by chemical, biochemical, histological and quantitative histomorphometric analyses. **Results:** These studies revealed that under resorption conditions PC3 cells induce differentiation of osteoclasts and bone resorption, whereas under bone formation conditions in the presence of phosvitin and vitamin C individually or in combination led to osteoblast differentiation and bone formation. **Conclusion:** These results demonstrated that the phenotypic expressions of cancer and bone cells are dependent on the specific bone remodeling stage and can be modulated by agents such as phosvitin/vitamin C.

Adhesive and Surface Conditioning Effect on Bracket Bonding to Ceramics

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Objective: To evaluated the effect of ceramic surface treatments on bond strength of metal brackets to machinable ceramics and veneering porcelain using different adhesive resins**. Methods:** Machined ceramic specimens (10x10x2 mm thick) were prepared from VITABLOCK mark II (Vita) and IPS e.max CAD (Ivoclar). Layered porcelain fused to metal (D.Sign-Ivoclar) was used to create the PFM specimens (n=60/ Group). Half of the specimens were etched (9.6% HF, 15sec) and the rest were non-etched. Three resin bonding systems were used for attaching metal brackets (Victory series^{Tm}APC II, 3M) to each group (n=10): Transbond-XT^{TM}(3M) , Lightbond™(Reliance), or Blugloo™(Ormco), all cured with LED curing unit (Bluephase G1600, Vivadent) for 50 sec each. Specimens were immersed in de-ionized water at 37^{O}C for 24 hour prior to shear bond testing (Instron) at a crosshead speed of 0.5 mm/min. ANOVA and post-hoc multiple comparisons were used to analyze the differences among groups.
Results: The means±SD (MPa) of shear bond strength for each group were:-

	Transbond-XT^{TM}		Lightbond™		Blugloo™	
Surface Treat	Non-Etched	Etched	Non-Etched	Etched	Non-Etched	Etched
D.Sign	13.46± 2.38	20.00±3.32	11.26±2.38	18.32±4.02	12.63±4.03	20.30±3.17
VITABLOCK	14.68±4.98	21.37±2.91	12.57±2.68	17.15±3.98	21.33±2.79	23.50±4.84
IPSemaxCAD	13.87±2.47	18.60±3.25	11.31±2.64	13.19±3.89	14.24±4.41	21.74±2.84

Significant differences in shear bond strength were found ($p \leq 0.05$) related to ceramic type, ceramic surface treatment method, and resin cement. **Conclusion:** Bond strength of metal bracket to ceramic is affected by type of ceramic, resin cement, and ceramic surface conditioning. Etching the ceramic surface enhanced ceramic-bracket bond strength. However, bond strengths in non treated ceramic surface groups were still higher than bond strength required for bonding in orthodontic treatment.

Three-Dimensional Analysis of Pharyngeal Airway Development

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Objectives: To establish normative reference data and examine changes to the pharyngeal airway at different pubertal stages as determined by skeletal age (hand/wrist radiographs). -To determine volumetric airway differences that may exist between males and females **Materials & Methods:** Pre-treatment Cone Beam Computed Tomography (CBCT) films of 77 human subjects were examined. Subjects were selected for ethnicity (Caucasian), normal BMI and skeletal class I relationship. Patients who were medically compromised, had incomplete records, history of craniofacial trauma, asthma, sleep apnea, posterior cross-bite, maxillary constriction, mouth-breathing, lip incompetency, “adenoidal” facial characteristics, previous orthodontic treatment, low tongue posture in CBCT or films not taken in natural head position were excluded from the study. Subjects were placed into three groups using a skeletal maturity assessment of hand-wrist radiographs. Using skeletal maturity indicators (SMI) to assess growth status, subjects were placed into (T1: SMI1-3) pre-pubertal, (T2: SMI4-7) pubertal or (T3: SMI8-11 or 25-40yrs) post-pubertal groups. Statistical Analysis: InVivoDental5 software (Anatomage, Calif) was used to calculate pharyngeal airway total volumes (TV) and minimum cross-sectional areas (MCA). TV boundaries were from a true horizontal line extended from PNS (palatal plane) to top of the epiglottis (E2-E1 line), anteriorly bordered by soft palate, base of tongue, and anterior wall of the pharynx. Descriptive, ANOVA, and un-paired t-test analyses were performed. **Results:** The mean total volumes were 9,678mm3±1.17 for the pre-pubertal group, 13,158mm3±0.92 for pubertal, and 12,474mm3±0.71 for post-pubertal. The mean cross-sectional areas were 129.77mm2±25.43 for the pre-pubertal group, 181.71mm2±14.40 for the pubertal, and 151.03mm2±11.66 for post-pubertal. Comparing the means there were no statistically significant differences amongst the groups ($p>0.05$). Data on gender differences for both total volume and mean cross-sectional area at the three growth stages was only statistically significant for post-pubertal (T3) total volume with males being larger at 15,286mm3 than women at 11,771mm3. **Conclusion:** No statistically significant differences were found amongst the skeletal age groups in this study; however there may be undetected clinical significance due to small sample size. The overall trend of the data showed that though males began with overall smaller airway volumes than women, as they approach and pass through puberty the males’ airway growth catches up to and surpasses the females’. This growth trend is in accordance with the overall statural and mandibular growth observed in males. Further studies with increased sample size and ablation of adenoids will need to be performed to account for soft tissue influence on volume and to potentially detect further statistical differences. The results of this study offer valuable reference data that can be used as a baseline for future studies.

Gluten-degrading Bacteria from Human Fecal Samples

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Introduction and Aims: Celiac Disease is a chronic inflammatory disorder of the small intestine characterized by an aberrant immune response to gluten proteins (primarily gliadins) in genetically predisposed individuals. Gluten proteins are rich in proline and glutamine residues, and certain immunogenic domains are highly resistant to degradation by human digestive enzymes. We have presented evidence that gluten-degrading enzymes are produced by bacteria that naturally colonize the oral cavity. Since the downstream region of the human gastrointestinal tract harbors more microbes than any other body compartment, the aim of the present study was to isolate gluten-degrading bacteria from human feces. **Materials and methods:** Aliquots of human fecal samples were collected under aseptic conditions from 3 healthy human subjects and suspended in 1 ml phosphate buffered saline. A 10-fold serial dilution was prepared and 50 µl aliquots were plated aerobically and anaerobically on gluten agar. Strains were subcultured to purity on blood agar. Gluten degradation by the bacterial strains was assessed in gliadin zymograms which were developed at pH 4.0 and pH 7.0. **Results:** Using the selective plating approach, 278 strains were isolated. Of the 78 strains so far evaluated by zymography 14 showed evidence for gliadin degradation in gel. Two strains were active at pH 4.0 (strains FA-10 and FA-13). This is an ongoing study where the ultimate goal is to characterize all 278 strains with respect to enzymatic activities directed at gliadins. **Conclusion:** Using the selective plating approach, gluten-degrading microorganisms were successfully isolated from feces. Especially the gluten-degrading enzymes with a low pH activity profile are of interest to be further exploited in the treatment of celiac disease. Supported by NIAID AI087803 Grant.

Effect of Posterior Crossbite on Lower Face Height, a CBCT Study

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Background: Posterior crossbite is one of the most common malocclusions present in the deciduous and mixed dentition. Its presence has been argued to negatively influence masticatory performance, affect growth of maxilla, mandible and even modify the temporomandibular joint. Aim: To explore if a correlation exists between increased frequency of clinical crossbites and increased lower facial height through the analysis of Cone-Beam Computerized Tomography (CBCT) images. **Material and Methods:** The initial records of orthodontic patients including CBCT scans were obtained retrospectively from the database of private orthodontic practices. We identified 44 study subjects with clinical posterior crossbite and 86 control subjects who were selected based on the absence of posterior crossbites and no evidence of skeletal transverse discrepancy. Pre-treatment constructed lateral cephalograms from CBCT scans were traced using imaging software (Vistadent Version 4.3.12). The null hypothesis was tested using Student's t-test. **Results:** We found a statistically significant increase in mandibular plane angle (p=0.001), lower facial height (p=0.001), palatal plane to mandibular plane angle (p=0.01), gonial angle (p=0.04), Y-axis (p =0.005), anterior face height (p=0.001), and decreased mandibular arc (p=0.03) and facial axis(p =0.001) in the study group. Furthermore, there was a decrease in ratio of anterior face height to posterior face height (p=0.005) and upper to lower face height (p=0.003) in the study group. There was no statistically significant difference in the measurements of ramus height (p=0.50), and Frankfort horizontal to occlusal plane angle (p=0.34) between the two groups. **Conclusion:** From the results of the study we can see that the presence of clinical posterior crossbite is associated with an increased lower facial height. Further studies are needed to evaluate whether resolution of dental crossbite will normalize the dentoalveolar dimensions.

Mechanism of Phosvitin-induced Connective Tissue and bone Organogenesis

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Introduction: Ascorbate (Vitamin C) is an essential component of the mechanism by which stable collagen is synthesized for the formation of connective tissue and bone. The function of ascorbate is to act as a reducing agent in the regeneration of ferrous ion (Fe+2) from its oxidized form ferric ion (Fe+3) which is formed during the hydroxylation of prolyl residues of collagen by prolyl-hydrxylase in the presence of Fe+2. Phosvitin is one of the most highly phosphorylated protein in nature and have been shown to have reducing characteristics. In our live bone organ culture model systems, we have shown that phosvitin can induce new bone formation. **Study Aims:** To determine the chemical and biochemical mechanism(s) by which egg yolk phosvitin facilitates stable collagen formation and hence connective tissue and bone formation in the absence of ascorbate (vitamin C). **Materials and Methods:** To test whether phosvitin-induced new bone formation is due to its capacity to act as a reducing agent similar to ascorbate in the mechanism of collagen synthesis a synthetic peptide with sequence containing recognition to prolyl-hydraxilase was used. In vitro test tube reactions were set up as follows: (a) a positive control, synthetic peptide + Fe+2 + α-ketoglutarate + osteoblast cell lysate (as a source of prolyl-hydroxylase); (b) synthetic peptide + Fe+3 + α-ketoglutarate + ascorbate + osteoblast cell lysate; (c) synthetic peptide + Fe+3 + α-ketoglutarate + phosvitin + osteoblast cell lysate; (d) synthetic peptide + Fe+3 + α-ketoglutarate + osteoblast cell lysate. The hydroxylation of the prolyl residues within the synthetic peptide substrate were determined by mass spectrometry. **Results:** These preliminary in vitro test tube studies indicated that at least one of the potential actions of phosvitin in new bone formation is its ability to facilitate prolyl hydroxylation under the above conditions which may provide bases for the observed new bone formation in our bone organ culture model systems.

Three-dimensional CBCT Analysis of Morphology in Patients with Mandibular Asymmetry

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Objectives: The purpose of this study is to investigate which anatomic areas contribute to asymmetry in patients with asymmetric mandibles. **Methods:** 43 adult patients were divided into mandibular symmetry (n=23) and mandibular asymmetry groups (n=20), with asymmetry being defined as at least a 2° deviation between Me-ANS and the midfacial plane. Patients included had no history of trauma, temporomandibular disease, or craniofacial tumors. Three-dimensional cone-beam computed tomography (CBCT) scans were used to locate surface landmarks that represented condylar, coronoid, gonial angle, body and chin units. Three-dimensional landmarks were used to calculate the dimensions of each area. For each measurement, the difference between the two sides in the asymmetry group was compared to the difference between the two sides in the symmetry group. Student's t-test was used to test the differences between the 2 groups for significance. **Results:** The difference in coronoid unit length and chin unit length between the right and left sides was significantly greater in the asymmetric group ($p = 0.03$ and $p = 0.02$, respectively) than in the symmetric group. The differences in ramal height, body length, condylar length, gonial angle length, and condylar width between the symmetric and asymmetric groups were not found to be statistically significant. Within the asymmetric group, the side toward which the chin was deviated had on average a longer condylar unit, a longer coronoid unit, a wider condyle, but a shorter mandibular body and chin unit. **Conclusion:** Asymmetry in the coronoid unit length and chin length seem to be a consistent feature in mandibular asymmetry patients. The heterogeneity of mandibular asymmetry may explain the lack of consistent asymmetry in other areas such as mandibular body length, ramal length and condylar length. Comparison of unit volumes between the two groups will be investigated.

Osteochondroma of Mandibular Condyle: Conservative vs Aggressive Treatment

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Purpose: Compare clinical outcomes of the conservative approach (low condylectomy with joint preservation) with the traditionally recommended radical approach (complete condylectomy with joint replacement); and to evaluate results using a single stage comprehensive surgical management of osteochondromas and associated dentofacial deformities. **Materials and Methods:** Total of 11 patients were treated, 5 (group I) patients underwent aggressive treatment with complete condylectomy, joint replacement and orthognathic surgery; and 6 patients (group II) were treated with low condylectomy with re-contouring of the condylar neck, disk repositioning and orthognathic surgery. The inclusion criteria were: 1) histopathologically confirmed TMJ osteochondroma; 2) progressive facial asymmetry; 3) progressive change in occlusion; 4) single-stage tumor removal and TMJ reconstruction; and 5) orthognathic surgery. Evaluations were performed pre-surgery (T1), immediately after surgery (T2) and longest follow-up (T3). Subjective and objective evaluation was used and included TMJ pain, headaches, jaw function, diet, disability, maximal incisal opening and lateral excursion. Average post-surgery follow-up was 68 months. **Results:** Both groups demonstrated significant clinical improvement, no tumor recurrence, no permanent facial nerve injury, and stable orthognathic result; group I had longer operating room time, with subsequent donor site complications; group II had shorter operating room time, faster post-operative recovery and less complications associated with surgical site. **Conclusions:** Both conservative and aggressive management are viable options for surgical management of TMJ osteochondromas. If TMJ reconstruction is required, patient-fitted TMJ replacements provide similar clinical outcomes as compared to autogenous reconstruction, but have the advantages of eliminating donor site morbidity and decreased operating time. Orthognathic correction of dentofacial deformities can be predictably performed at the time of tumor removal.

Mandibular Stability after Total Joint Replacement

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Objectives: The objective of this study was to evaluate long-term changes in stability, function and pain in patients who had total joint prostheses placed due to adolescent idiopathic condylar resorption (AICR). The specific aim of this study was to evaluate whether AICR patients with total joint replacements have stable results and improvement in pain and function postoperatively. **Methods:** Retrospectively, 25 patients who had been diagnosed with AICR and had had total joint prostheses placed were evaluated for skeletal stability, mandibular function and pain. Measurements from immediate postoperative and longest available follow-up were compared. Cephalometric radiographs were used to measure changes in the jaws vertically and horizontally. Changes in the occlusal plane, SNA, SNB, the mandibular plane angle (MPA), total mandibular length (Go-Gn), palatal plane angle and gonial angle determined skeletal stability. Visual analog scales evaluated changes in levels of pain and jaw function. Maximum interincisal opening and lateral excursive movements were compared between time points. **Results:** The average postoperative follow-up time was 14.85 months. At the longest follow-up the occlusal plane, palatal plane, SNA, SNB and Go-Gn showed very little change relative to the immediate postoperative timepoint. On average, the MPA decreased by 2.1° ±0.5 and the gonial angle decreased by 2.03° ± 0.77. Although both values were statistically significant ($p<0.05$), neither was clinically significant. Postoperatively, the maximum interincisal opening increased by an average of 3.8mm ±0.9 but lateral excursive movements decreased significantly, as was expected due to the nature of the prosthesis. All patients reported an improvement in function. However, 2 patients reported no improvement in pain, and 1 reported having worse pain than preoperatively. **Conclusion:** Total joint replacement used in the treatment of patients with AICR has been shown to be skeletally stable and improves function and pain levels in the large majority of patients.

N-glycosylation Gene, DPAGT1, Functions as an Oncogene

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Protein N-glycosylation is essential for viability and plays critical roles in tissue development and homeostasis. Our previous studies have shown that DPAGT1, a principal regulator of protein N-glycosylation, controls the N-glycosylation status and activity of the major epithelial cell-cell adhesion receptor, E-cadherin, and of components of canonical Wnt signaling, including Wnt ligands, receptors and co-receptors. DPAGT1 itself is a transcriptional target of Wnt/β-catenin signaling. Recently, we reported that DPAGT1 and canonical Wnt/β-catenin functioned in a positive feedback loop, and that unwarranted activation of this loop was a feature of human oral squamous cell carcinoma (OSCC). Both N-glycosylation and canonical Wnt signaling represent highly conserved core pathways whose aberrant activation drives OSCC initiating events, including the loss of E-cadherin adhesion. To test the role of DPAGT1 in promoting cancer development and progression, we stably transfected DPAGT1 cDNA into normal canine kidney, MDCK, cells and showed that a 2.5 fold upregulation of DPAGT1 mRNA level resulted in a 10-20 fold upregulation of canonical Wnt activity as judged by the expression of the luciferase reporter gene activity from the TOP-Flash vector. The fact that DPAGT1 can drive canonical Wnt activity in MDCK cells suggested that it may play a role in tumorigenesis. Here, we show that 2-3-fold overexpression of DPAGT1 in MDCK cells is associated with increased expression of key markers of epithelial to mesenchymal transistion (EMT), including vimentin, CTGF, N-cadherin and fibronectin. In addition, we find that DPAGT1 induces expression of pro-tumorigenic proteins, including a promigratory CTHRC1 and a junction destabilizer, IQGAP1. This EMT-like behavior of DPAGT1 transfectants is associated with dramatic changes from epithelial to mesenchymal morphology that are associated with increased stress fibers, activation of RhoA and loss of junctional E-cadherin. We propose that N-glycosylation gene, DPAGT1, functions as an oncogene by driving cells toward an EMT. Supported by NIH/NIDCR RO1DE014437 Grant.

Identification of Vimentin-Enriched Cells in Embryonic Submandibular Glands After Wounding

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The inductive interactions between epithelial and mesenchymal cells play a role in the embryonic development of various epithelial tissues, including the submandibular gland (SMG). Specifically, epithelial-mesenchymal transition (EMT), characterized by morphological and molecular changes in epithelial cells as a result of trans-differentiation towards a mesenchymal phenotype, has been shown to play a role in development and wound healing. A marker found in cells undergoing EMT is the intermediate filament vimentin, which is expressed in mesenchymal cells. An increase in vimentin expression has been reported in cells surrounding a wound and is thought to increase cell migratory ability to facilitate a more efficient healing process. However, the existence of repair cells and mechanisms in response to SMG tissue injury have not been elucidated. **Methods:** We used the mouse SMG ex vivo culture at E13.5 as a wounding model to test for the existence of repair cells. We examined the consequences of injury caused by a needle stick by assessing morphological changes, vimentin expression and presence of pyknotic nuclei in wounded and non-wounded glands by light microscopy and immunofluorescence localization. **Results:** Unwounded glands showed an endogenous group of vimentin positive cells in the bud and stalk. Following injury, there was a dramatic increase in vimentin positive cells at the site of injury at 1h, which continued to increase at injury site concomitant with pyknotic nuclei at 18h. This suggests cells undergo cell death while vimentin positive cells are recruited. 48 hours post injury, neither vimentin positive cells nor pyknotic nuclei were detected, suggesting the completion of the repair process. **Conclusion:** We show the mouse SMG ex vivo culture can serve as a model for SMG tissue repair. Furthermore, we provide evidence that the SMG contains a small number of vimentin positive cells that are recruited and expanded in response to injury. Supported by NIH/NIDCR RO1DE014437 Grant.

A Retrospective Review of Emergency Room Visits for Dental Reasons in Adults

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Objectives: On July 1, 2010 MassHealth (Medicaid) stopped its dental coverage for adults in Massachusetts. The purpose of this retrospective cohort study was to analyze the rate of people utilizing ERs for dental services before and after the MassHealth reform. **Methods:** The study examined the use of ERs for dental services at Boston Medical Center (BMC) by persons 21 years or older, 3 years before and 2 years after the Massachusetts Health Care Reform (July 1st 2007 to June 30th 2012). This project used administrative data from BMC (a large urban teaching/ safety-net hospital serving Boston). The study included persons 21+ years with diagnoses related to dental ICD codes. Demographic characteristics of the users of ER dental care (age, sex, race and ethnicity) and diagnoses are described. Percent increases by age-group, race/ethnicity and insurances were calculated. **Results:** Dental visits comprised 5.9% of ER visits over the time period studied. Compared with three years before MassHealth reform, dental-related ER visits increased by 3% in 2010-2011 and 17% in 2011-2012. Increases by year were 7% and 22% among Blacks/African Americans, -1% (slight decrease) and 14% among Hispanics/Latinos and 39% and 37% among the Middle Eastern users of ER dental care. Two year increases with age-group were higher in each age-group. Visits also increase over two years among persons with Medicare (19%), Medicaid (17%), and Charity care (38%). Dental caries and soft tissue pathology had the largest % increases. Discussion: The greatest increases in care were among racial and ethnic minorities, older adults and persons receiving Medicare, Medicaid and charity care. Based on the diagnoses associated with their care ER users for dental care would be better served (at a lower cost) in primary care settings rather than the ER. **Conclusion:** ER care for dental problems increased at a major safety net hospital in Boston when Medicaid coverage for dental care was reduced. Supported by NIH/NIDCR K24 DE018211 Grant.

Effect of Different Cements and Geometry on Bonding Strength of Titanium to Zirconia

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Objectives: Determine strengths of taper joints of titanium cemented to zirconia, using Multilink Automix and RelyX Ultimate cements, for two joint geometries using an axial tensile pull-out test. **Materials and Methods:** Zirconia rings were made by dry pressing and sintering TOSOH TZ-3YSB-E powder using a custom designed die set. Taper pins were made from Grade 2 titanium with a taper of 8.2 degrees included angle; this value was selected because it is essentially equal to that of Sirona abutments. Sirona blocks were sintered, and abutments and taper pins were sandblasted. The cements were used as per the manufacturers' directions. Cement was applied to the sandblasted conical surface of the titanium pins, which were then inserted into the zirconia rings. An axial load of 3,570 grams was applied to the assembled specimens. Excess cement was removed using a scalpel blade. Specimens were then exposed to a curing light to initiate curing of the cement. After 24 hours, specimens were tested by axial tensile load. Similar procedures were followed using both cements and Sirona specimens. **Results:** Mean values for both Multilink Automix (1018N) and RelyX Ultimate (715N) cements were larger for titanium taper joints compared to Sirona (280N and 278N respectively). **Conclusion:** Multilink Automix cement had larger pull out loads than RelyX Ultimate cement for taper pins and rings, while abutments and blocks had similar pull out loads for both cements. Taper pins and rings had larger pull out loads than Sirona abutments and blocks for both cements indicating that geometry has a significant effect on bond strength. It is hypothesized that cement gap plays an important role in these results. Support from Vita Zahnfabrik, Bad Sackingen, Germany

Strength of Esthetic Brackets During Archwire Tipping

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Objectives: To fabricate esthetic orthodontic brackets from different materials and compare their fracture resistance under second order arch wire activation (tipping) to those of conventional ceramic brackets in vitro. **Methods:** CAD/CAM (Cerec inLab, Sirona) was used to mill orthodontic brackets with 0.018 x 0.025 inch-slot of different materials: composite (MZ100, 3M ESPE), feldspathic porcelain (MKII, Vita Zahnfabrik) and Yttria stabilized Zirconia (In-Ceram YZ, Vita Zahnfabrik). 10 brackets of each material were subjected to tipping by a 0.018 x 0.025-inch stainless steel arch wire (G&H) using a specially designed apparatus attached to an Instron Universal Testing Machine. The loads (gf) at failure were recorded. The average moments and degrees of tipping necessary to fracture the brackets were determined and compared to those of two types of commercially available alumina brackets: Mystique and Resolve (Dentsply GAC) tested in the same manner with equivalent sample sizes. **Results:** YZ brackets were statistically significantly stronger than any other tested material in their resistance to tipping. Material Moments at Failure (gm.mm) Significant Difference Tipping Angle at Failure (°) MKII 5430.2 ± 1341 A 7.6 ± 2 MZ100 8859.8 ± 1897 B 14.8 ± 2 Resolve 10051.4 ± 1690 B 12.5 ± 2 Mystique 15034.7 ± 2372 C 19.3 ± 4 YZ Zirconia 27193.9 ± 4216 D 48 ± 19 ANOVA and Tukey at p=0.05, groups with different letters are significantly different. **Conclusion:** Although Zirconia had the highest strength under arch wire tipping among the tested brackets, the clinically used tipping moments for second order arch wire activation are much smaller than those required to fracture all brackets used in this study. Support from Vita Zahnfabrik, Bad Sackingen, Germany

Anatomy of Dentate Segment of Mandible: Study of Cone Beam CT Scans

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Objectives: To evaluate detailed anatomy of the dentition-bearing portion of mandible using Cone Beam CT scans. **Materials & Method:** The study involved an analysis of cone-beam CT scans of the dentate mandibular segment by the Department of Oral & Maxillofacial surgery in the Boston University Goldman School of Dental Medicine. Criteria for exclusion included 1. Presence of pathology of the mandible, 2. Presence of internal hardware (e.g.: plates, screws, implants, etc), which could cause artifacts, and, 3. Prior mandibular surgery. Each scan was evaluated for the following data: 1. Width of alveolar ridge, 2. Width of buccal cortex, and, 3. Width of lingual cortex, 4. Horizontal dimension of inferior alveolar nerve (IAN), 5. Vertical Dimension of IAN, 6. Distance between IAN and teeth apices, 7. Distance between IAN and buccal cortex, 8. Distance between IAN and lingual cortex, 9. Distance between IAN and inferior border of mandible (IB), 10. Width and location of mental foramen, 11. Distance between mental foramen and IB, 12. Distance between the mental foramen and the teeth apices. Results: A total of 50 mandibular CBCTscans were reviewed. 25 male and 25 female subjects were included. **Results:** The results were as follows: 1- Average width of alveolar ridge was 8.97mm (r: 6.22 to 14.25). 2- Average width of buccal cortex was 2.46mm (r: 1.12 to 4.2). 3- Average width of lingual cortex was 2.32mm (r: 1.18 to 2.42). 4- Average horizontal dimension of IAN was 3.41mm (r: 2.88 to 3.45). 5- Average vertical dimension of IAN was 4.66mm (r: 3.18 to 4.73). 6- Average distance between IAN and teeth apices was 3.9 (r: 0.9 to 5.88). 7- Average distance between IAN and buccal cortex was 4.76mm (r: 2.13 to 8.3). 8- Average distance between IAN and lingual cortex was 3.06mm (r: 0.3 to 4.78). 9- Average distance between IAN and IB was 8.24mm (r: 4.38 to 10.48). 10- Average width of the Mental foramen was 4.15mm (r: 3.5 to 4.2. 11- Mental foramen was located apical to second premolars in over 90% of scans. 12- Average distance between the mental foramen and IB was 14.2 (r: 9.88 to 14.57). 13- Average distance between the mental foramen and teeth apices was 5.07mm (r: 4.18 to 5.31). **Conclusion:** The findings of this study point some important landmarks and measurements that surgeons should keep in mind while performing mandibular surgery to minimize the possibility of iatrogenic damage to vital anatomic structures. 3rd molar surgery: The IAN was found to be lingual in relation to the 3rd molars in 100 % cases, thus, removal of buccal bone for exposure and removal of third molars remains a safer choice as opposed to the older lingual-split technique. Internal fixation in trauma, reconstructive and orthognathic surgery: We recommend the use of ¡Ü4 mm length within the neutral zone if bone screws are to be used to avoid iatrogenic damage to the IAN. Based on the range of alveolar width measurements, it appears that 8-10 mm length screws can be usually safely placed without injuring the lingual nerve during rigid fixation of osteotomies and mandibular fractures in the 3rd molar and

adjacent ascending ramus area. Rotary instrumentation: The surgical burs commonly used in mandibular orthognathic surgery have a 6mm cutting surface; in order to avoid IAN damage, we recommend initially using only half the length of the bur while making the vertical buccal cuts of a sagittal split osteotomy procedure, and then assessing the need for increasing the depth by checking presence or absence of bleeding (cancellous) bone.

Role of Ellis-van Creveld Syndrome2 (Evc2) in Postnatal Craniofacial Growth

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Ellis-van Creveld syndrome (EvC) is a rare chondro-ectodermal dysplasia with an autosomal recessive trait. The syndrome has been linked to either mutation of the closely located EVC and EVC2 genes on chromosome 4. The clinical manifestations of the disease-phenotype could be highlighted in four major congenital anomalies: chondral dysplasia, manifested as a disproportionate dwarfism; ectodermal dysplasia of the nails, teeth, and sometimes hair; polydactyly; and congenital heart disease in up to 60% of cases. In addition, some EvC patients showed craniofacial deficiency that required orthodontic intervention. **Methods:** In this study we investigated the postnatal craniofacial skeletal morphology in Evc2 knockout (KO) mice compared to that in the controls (i.e. wild type and heterozygous mice). Evc2 KO mice were generated and cephalometric analysis was conducted on three age groups. Based on fourteen reference points, thirteen morphological distances and twenty-two angular relationships were measured. **Results:** Our results showed a resemblance in the growth curve of KO to the controls with a gap or shortage in the capacity of growth ranging between 26.2 to 21.2 % by the time reaching to the older group. Notably, growth of certain bones including nasal bone, palatal bone and premaxilla were more affected in KO than in the controls. Furthermore, there was a remarkable change in the spatial bones relationship to the cranial base and vault. **Conclusion:** Our study demonstrates that Evc2 is required for postnatal craniofacial bone development in a region specific manner, and further suggests the clinical importance of early orthodontic analysis and possible intervention for EvC patients. Supported by NIH/NIDCR RO1DE019527 grant.

Stability of Mandibular Anterior Alignment Following Piezo-facilitated Orthodontics

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Objectives: 1. To evaluate the stability of orthodontic alignment in the mandibular anterior segment following piezo-facilitated treatment at least 1 year after treatment. 2. To determine the stability of bone graft on CBCT 1 year post treatment in cases treated with piezocision and alveolar augmentation. **Methods:** Ten patients who underwent piezo-facilitated orthodontic treatment in the Department of Orthodontics were evaluated. All had a mean of 4mm (range 2-6mm) mandibular anterior crowding and were treated nonextraction. Bone grafts were placed in the incisor area for periodontal support. Measurements were made on study casts from 3 different time points: T1 (pretreatment); T2 (post-treatment); and T3 (at least 1 year posttreatment). These included arch perimeter and depth, irregularity index, and intermolar and intercanine widths. Buccal bone thickness measured on CBCT scans taken pretreatment and longterm were compared to assess stability of the graft. **Results:** 2-tailed paired t-tests were used to compare the timepoints pairwise. Preliminary results show a significant difference between T1 and T2 in all parameters except intermolar width. Relapse averaging 28% was noted from T2-T3 with a significant increase in incisor irregularity (28%) and decreases in arch depth (29%) and perimeter (27%). Nonetheless, there was still significant change between T1 and T3. The literature reports 35% relapse of incisor irregularity. Thus, with 28% relapse, this study compares favorably with stability values found in the literature, but this may not be significant. Comparison of buccal bone thickness between T1 and T3 shows a significant increase long term. **Conclusion:** Orthodontic tooth movement after piezo-facilitated orthodontics shows moderate stability after 1 year posttreatment which compares favorably with values in the literature. Thus, piezo-facilitated orthodontic tooth movement with bone graft accelerates the tooth movement but provides no greater stability.

Synchrony of Protein and Microbial Attachment in Early Dental Integuments

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Objectives: The initial tooth integument formed on enamel surfaces is the acquired enamel pellicle (AEP) which is formed by the selective adsorption of oral fluid proteins and peptides. This is followed by selective binding of oral microorganisms. Our recent studies have identified the early microbial colonizers in the 0-6h time frame, using DNA-DNA hybridization checkerboard and HOMIM microarray technologies. The sequential and parallel pattern of AEP and biofilm formation, though, has not yet been characterized. Insights into the mechanistic driving forces of these processes are vital for understanding the transitions from physiological to pathological conditions. The objective of our studies is to understand the biochemical determinants that dictate protein as well as bacterial adsorption, and to correlate both processes to ultimately gain insights into the critical steps in the formation of mature dental biofilm. **Methods:** Tooth integuments were collected at 0, 2, 4 or 6 hours after thorough cleaning of tooth surfaces. The proteins in the AEP samples are being quantitatively analyzed using label-free LC-ESI-MS/MS, whereas the microbial compositions were determined using the HOMIM microarray. **Results:** Samples have been obtained from 7 participating orally healthy subjects. Our earlier data indicated that the bacterial binding for the first 6 hours of integument formation comprise predominantly the species of Gemella haemolysans, Streptococcus cristatus, S. oralis, S. parasanguis I and II ($p<0.05$) as well as S. anginosus and intermedius, S. mitis and S. Cluster I. Both the raw label free LC-ESI-MS/MS data and microbial results will be computed to evaluate and correlate the protein and species patterns of early biofilm development. **Conclusion:** With the in vivo AEP/early biofilm collection techniques developed in our laboratories and novel sensitive quantitatition assays new insights will be gained into the interplay between protein/peptides and bacteria in early tooth integuments. NIH grants: AI087803, DE05672, DE07652 NSERC grant: 371813 CIHR grants: 106657, 97577 CFI-LOF grant: 25116 WLS is recipient of a CIHR New Investigator Award (grant : 113166).

The Effect of Veneering Ceramic and Method on the Failure Load of Veneered Zirconia

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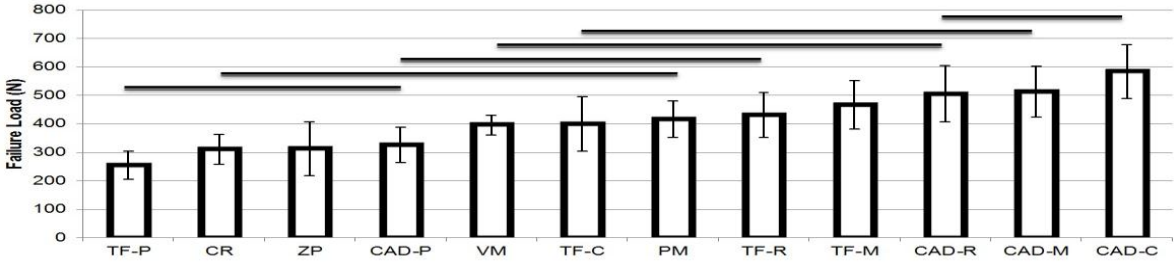
A variety of veneering options to zirconia frameworks are now available. **Objective**: The purpose of this study is to evaluate the effect of veneer materials, veneering methods, interface materials, and aging on the failure load of bilayered veneer-zirconia. **Method**: Zirconia bars (20x4x1mm) were veneered to 2mm total thickness (n=10/group). Veneering-method groups included: 1. Hand-layered feldspathic porcelain (VM=Vita VM9, Vident) and fluorapatite glass-ceramic (CR=IPS e.max Ceram, IvoclarVivadent); 2. Pressed feldspathic porcelain (PM=Vita PM9, Vident) and fluorapatite glass-ceramic (ZP=IPS e.max ZirPress, IvoclarVivadent); 3. CAD/CAM milled feldspathic ceramic (TF=Vitablocs Trilux Forte, Vident) and lithium-disilicate glass-ceramic (CAD=IPS e.max CAD, IvoclarVivadent). CAD/CAM veneers were either cemented with resin cements (P=Panavia21, KurarayDental), (R=RelyX Ultimate, 3M ESPE), (M=Multilink Automix, IvoclarVivadent) or fused with fusion glass-ceramic (C=CrystalConnect, IvoclarVivadent). A Three-point bending test (15mm-span, zirconia on tension-side) was performed on Instron universal testing machine (ISO 6872) recording load-to-failure (LTF) of first veneer cracks or catastrophic failure. For group VM, PM, TF-M, TF-C, CAD-M, CAD-C, ten more bars were prepared and aged with cyclic loading (100,000-cycles, 50%LTF) and thermocycling (2,000-cycles) before testing. Data were analyzed by ANOVA, Tukey HSD post-hoc tests, and t-test (α=.05). **Results**: Mean failure loads (Newton) and SD of non-aged bilayered veneer-zirconia bars are shown in the graph below:



Horizontal lines connect groups that are not significantly different.

The aging experiment revealed a significant difference in failure load between non-aged and aged bars in groups VM and PM, but not in the groups with CAD/CAM milled veneers. **Conclusions**: Veneer materials, veneering methods, and interface materials have a significant effect on the failure load of bilayered veneer-zirconia. CAD/CAM milled veneer-zirconia is not susceptible to aging performed in this study.

Idiopathic Condylar Resorption: Analysis of outcomes following TMJ Total Joint Replacement

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Statement of Problem: Idiopathic condylar resorption (ICR) continues to present a major diagnostic and therapeutic challenge to practitioners for many reasons including rarity of the condition, progressive nature of the deformity, and its simultaneous involvement of skeletal, occlusal and articular disorders. Recommended treatment alternatives range from no surgery, only orthognathic surgery (maxillary impaction and chin camouflage surgery), staged TMJ and orthognathic surgery, to concomitant TMJ and orthognathic surgery. Traditionally, costochondral grafts have been used for TMJ replacement in this sub-group of patients, but advances in technology and availability of modern, patient-fitted TMJ alloplastic replacement systems may offer many benefits over such autogenous replacement options. **Materials and Methods:** A retrospective analysis of all patients who underwent surgical treatment of ICR by a single surgeon at Boston University Medical Center hospital between 2000 and 2008 was performed. Criteria for inclusion in the study included: 1) Progressive mandibular retrusion secondary to TMJ resorption, 2) negative screening for known forms of systemic arthrides causing TMJ resorption, c) Absence of any history of trauma, 4) Presence of anterior open bite with Class II skeletal and dental malocclusion, and, 5) Surgical treatment involving bilateral TMJ total joint replacement and concomitant mandibular advancement with or without maxillary surgery. Clinical and radiographic examination was performed presurgically (T1), immediately postsurgery (T2), and at longest follow-up (T3). Visual analog scales were used for subjective examination of jaw function, dietary restrictions, functional disability, patient satisfaction, and pain at each of the above intervals. Objective examinations included: a) clinical evaluations of TMJ sounds, anterior open bite, occlusal relationship, mandibular range of motion (excursions, protrusion, and maximum opening), cranial nerve VII injury, and objectionable scarring, and, b) radiographic analysis by superimposition of cephalometric tracings for measurement of surgical change (T2-T1) and relapse (T3-T2). **Results:** A total of 21 patients were included in the study. The average patient age was 25.6 years (range 22 – 32) and average follow up was 3.4 years (R 2-8). All patients were females. 10/14 (70%) patients correlated the period of active orthodontic treatment to the initiation of resorption. All patients gave a history of clicking/popping of their TMJ's at some stage during their lifetime. Average surgical time was 8.5 hours (R 5.5-9) and the average duration of hospitalization was 2.6 postsurgical days (R 2-5). Average mandibular advancement at Point B was 18.9 mm (R 14-27) and average occlusal plane change was -6.8 degrees (R 3-8). 16/21 (76%) underwent maxillary orthognathic surgery for posterior downgrafting with rigid fixation and grafting. One patient had prolonged weakness of the frontal/temporal branch, which resolved completely in 7 months. Long-term follow-up revealed excellent stability of surgical movements with

significant decrease in TMJ and myofascial pain, headaches, and dietary restrictions. **Conclusion:** ICR patients can be treated very effectively using patient-fitted TMJ total joint prostheses for correction of TMJ resorption and mandibular advancement in combination with maxillary orthognathic surgery, when indicated for correction of the associated dentofacial deformity. Use of these prostheses eliminates donor site morbidity and allows for extremely large mandibular advancements to be performed in a predictable manner with a drastic reduction in TMJ dysfunction symptoms and excellent stability of orthognathic movements.

Endosseous Implants in Non-vascularized Bone Grafts: Outcome Analysis

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Purpose: To evaluate osseointegration of dental implants placed into non-vascularized bone grafts and to assess differences in outcomes with regards to jaw defect (type, size, etiology) and type of graft (autograft, allograft, xenograft, and alloplast). **Materials and Methods:** Retrospective review over a 7-year period (2003 - 2010). All patients were treated with non-vascularized bone grafts and subsequent placement of dental implants. A total of 522 implants were placed. Patients were allocated into one of four groups, based on recipient site: I - extraction socket (n = 94 implants), II - maxillary sinus (n = 164 implants), III - alveolar ridge (n = 141 implants); IV - continuity defects of mandible and/or maxilla (n = 124 implants). Details regarding demographics, co-morbidities, characteristic of the defect (type, size, etiology) were reviewed. Implant success was defined as retention of implant until second stage, absence of mobility, and ability to withstand functional load. Criteria for failure included implant mobility (> 1 mm), radiographic bone loss (> 1/3 implant height), infection, graft exposure and loss. **Results:** Overall, graft success rate was 99% and implant success rate was 97.1%. Mean follow-up was 6 months. Fifteen implants were removed due to mobility and/or infection. Success rates for implants were as follows: group I = 100%; group II = 96.9%; group III = 97.8% and, group IV - 94.3%. **Conclusion:** Endosseous implants have a high success rate when placed into alveolar defects reconstructed with non-vascularized bone grafts. The nature of the bony defect or type of non-vascularized graft used does not affect the final clinical outcome.

Incidence, Survival and Mortality of Oral and Oropharyngeal Cancer: A Surveillance, Epidemiology and End Results Program-based Analysis

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Background: Oral and oropharyngeal cancer (OOC) represents a significant public health burden, with approximately 275,000 cases diagnosed annually world-wide. There are known trends and differences in reference to race, gender and age. Moreover sub-site analysis has brought to light important etiologic factors such as the Human Papilloma Virus (HPV) that carries valuable prognostic and treatment implications. This study evaluated trends in OOC with particular emphasis on sub-site, race and age measuring crude outcomes measures. **Objectives:** The goal of this investigation was to further define patterns and trends that have occurred over the past 40 years. **Methods:** Data were extracted and analyzed from the population-based registry Surveillance, Epidemiology and End Results (SEER) database. Datasets included all neoplasms of malignant behavior specific to the following sub-sites: tongue, floor of mouth (FOM), gingiva and oropharynx. Patients were grouped into three age cohorts: 0-39, 40-64 and 65+. Incidence, survival and mortality trends were analyzed in time periods: 1973-79, 1980-86, 1987-94, 1995-2001, 2002-08 and stratified by race, gender and anatomic sub-site. Outcomes were measured by number of occurrences per 100,000 people. **Results:** The overall incidence of OOC was relatively stable over time. Males had a higher incidence of OOC with a marked difference between Black males and females (11.72 and 3.82 respectively). In a collective analysis there was a decrease in incidence (18.39 to 9.21) amongst Blacks 40-64. There was an increased incidence of tongue cancer amongst Whites in particular age groups; 3.84 to 5.65 in the 40-64 and 8.45 to 10.6 in the 65+. In an age-matched analysis, Blacks had an interval decrease of tongue cancer; 6.63 to 4.06 in the 40-64 age cohort. There was a significant decrease in the incidence of FOM cancer in all races (1.49 to 0.65). The incidence of gingival cancer was stable over time, however it was significantly decreased in Blacks in the 40-64 age group (6.02 to 2.31). White females >65 had a higher incidence of gingival cancer than Black females of the same age; 7.54 versus 5.32. Oropharyngeal cancer had the lowest incidence amongst the measured sub-sites; Blacks demonstrated an increased trend in both the 40-64 and 65 + cohorts. The overall 5-year observed survival (OS) rates for all sub-sites improved over time. Older age groups demonstrated a 34% mean improvement in survival. Blacks demonstrated the poorest OS irrespective of age, gender and sub-site. The mean difference in survival between Blacks and Whites ranged from 10-30%. The disease specific mortality has decreased over time in tongue, gingival and FOM cancer. Whites and Blacks had proportionate decreases in mortality in ages 40-64. Whites aged 65 + had a greater proportionate decrease in mortality compared to Blacks; 30% reduction versus 21%. Increased mortality was noted for oropharyngeal cancer in both age groups

above 40. Blacks 65 + had a 110% increase compared to 40% in Whites of the same age. **Conclusion:** This study was designed to raise awareness among practitioners of the trends in OOC. The data confirms known trends with respect to gender and age and will serve as a framework to develop early diagnostics and focus therapeutics in high-risk demographic sub-sites such as Black males, White males with tongue cancer and females with gingival cancer. Overall disease specific survival has improved in both Blacks and Whites, but less so for Blacks. Mortality for oropharyngeal cancers has increased two-fold. These points re-emphasize the importance of potential etiologic factors other than smoking and alcohol abuse, such as HPV. Further investigations will focus on factors that contribute to these differences in an effort to improve outcomes.