Stereophotogrammetry Imaging: An Approach for Screw Retained Implant Prosthesis Fabrication in Oral Rehabilitation

Dr. Mazen Khaled Aly
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Predoctoral Dental Student
Current Program Year: Fourth Year

Objectives: The aim of this poster is to provide thorough understanding of Photogrammetry Imaging and its implementation process from implants spatial positions recording to prosthesis delivery. A comparison to conventional and digital impression techniques is provided, focused on the relevance of the resulting passive fit of the prosthesis.

Methods: An electronic literature search was conducted by two independent reviewers in several databases, including MEDLINE, PubMed and Cochrane Central Register of Controlled Trials for articles up to July 2021 with no language restrictions.

Methods (Original Research) or Case History/Technical Steps (Case Presentation): Passive fit of a multiple-implant-restoration remains one of the most challenging aspects of partial- or full-mouth rehabilitation. It is defined as "the optimum fit of superstructures to abutments that determines the absence of bone tension without the occlusal loading" and is considered crucial for success and longevity of dental implant restorations. There is no agreement in the literature regarding an acceptable micro-gap, which might range between 10-150·m. Absence of precise fit yields biomechanical failures due to inadequate stress dissipation. Lack of fit between the framework and implants can be attributed to distortions occurring during the impression taking or model fabrication. Hence, in order to reduce distortions of traditional impression techniques, the use of photogrammetry has been proposed.

Results (Original Research) or Discussion: Outcome/Follow up (Case Presentation):

Photogrammetry is a newly introduced dental imaging system and is increasingly used by clinicians today. Further studies are needed to assess long-term impact on implants' osteointegration and prosthesis longevity. One of the major drawbacks is the inability to acquire peri-implant tissue in the scan, which requires an extra step of a physical/digital impression.

A Digital Workflow for Bracket Removal and Tooth Translation for Retainer Fabrication: A Case Report

Dr. Moshe Berger
University of Maryland
Predoctoral Dental Student
Current Program Year: Fourth Year

Objectives: The objective of this study was to utilize open-source software (MeshMixer) to reduce chair time by using digital model editing and manipulation. The research included digital debonding, tooth translation, and utilizing digital pontics in a simplified digital workflow.

Methods: An aesthetically driven patient was getting married abroad and wanted her brackets removed; however, the patient could not come to the clinic for an appointment to debond and rescan her (debonded) dentition then another appointment for essix placement. It was indicated to limit patient's visit to one by digitally editing the existing models to save time, A previous intraoral scan (3Shape TRIOS® Intraoral Scanner) cast was retrieved, digitally the wire was removed along with brackets (Autodesk meshmixer). The teeth were rotated and translated in an esthetic position, and sent to the lab for printing and essix fabrication. Once the orthodontic treatment is complete, prosthetic implants are planned to replace the patients missing maxillary central and lateral incisors.

Methods (Original Research) or Case History/Technical Steps (Case Presentation): The essix created from the digitally manipulated 3D printed model fit the patient ideally with no need for interproximal adjustments. The patient's cast with brackets and orthodontic wires were successfully removed and translated. Pontics were placed into the essix were the patient is missing teeth. Once the orthodontic treatment is complete, the prosthetic treatment will begin. This will include replacing the maxillary pontics with implants.

Results (Original Research) or Discussion: Outcome/Follow up (Case Presentation): The workflow proved to reduce chair time and simplify the digital workflow for debonding, tooth translation and pontic application in a clinical orthodontic setting.

Accuracy of Torque Control-Devices in Implant Dentistry: An In-Vitro Study

Mr. Varun Goyal
Stony Brook University
Predoctoral Dental Student
Current Program Year: Fourth Year

Objectives: When placing or restoring dental implants, the use of precise torque values is a prerequisite to avoid screw loosening, deformation, and fractures. The objective of this study is to evaluate the precision of torque-control devices used in implant prosthodontics.

Methods: In this study, two implant systems with different implant-abutment connections were evaluated. Group A (Ankylos, Dentsply-Sirona) and group B (Bone Level, Straumann) implants were immobilized securely with a laboratory bench clamp. Three torque-control devices were compared. Conventional torque-control devices (spring-based) for A- and B-implants were used to tighten healing abutments (n = 20) to pre-determined values of 15 Ncm. The removal torque was assessed with a digital torquemeter (DT, CEDAR DID-4A). In a second round, healing abutments were tightened using a pre-calibrated torque control (CTC, Anthogyr) with respective drivers, and the DT was used to remove the healing abutments. Values were recorded. Descriptive statistics, mean, and standard deviations were used to present the data. ANOVA analysis was completed to evaluate differences between groups, and post-hoc test was used to confirm multiple comparisons of differences between means. Significance was set as $p<0.05$.

Methods (Original Research) or Case History/Technical Steps (Case Presentation): The conventional torque wrenches did not present accuracy in torque values. Specifically, DT for A-implants removal torque was 16.05 (± 0.66) and for B-implants 12.61 (± 1.36) Ncm. The closest values to the DT were achieved by the CTC device ($p < 0.05$).

Results (Original Research) or Discussion: Outcome/Follow up (Case Presentation): Within the limitations of this study, inexact torque values were represented using the conventional torque wrenches. More calibration is required to control risks in implant prosthodontics.

The Effect of the Covid-19 Pandemic on Prosthodontic Education

Ms. Diana HeeRyang Joo
Touro College of Dental Medicine
Predoctoral Dental Student
Current Program Year: Fourth Year

Objectives: Prosthodontics is the dental specialty pertaining to the diagnosis, treatment planning, rehabilitation, and maintenance of oral function, comfort, appearance, and health of patients with clinical conditions associated with missing or deficient teeth and/or oral and maxillofacial tissues using biocompatible substitutes5. It requires in-person treatment of patients and often involves tooth preparation using high-speed handpieces that spread aerosol. These aerosols spread approximately 300-360 cm radius around the patients.6 For the safety of patients, faculty, and students, the Covid-19 Pandemic caused dental schools to modify their educational curriculum, protocols, and procedures. The Covid-19 Pandemic has caused a very unprecedented obstacle for pre-doctoral dental education. This research study would explore how the Covid –19 pandemic has affected the US dental educational institutions, specifically their prosthodontic curriculum, in both the didactic and clinical aspects. It will compare the different responses based on school/university location and quantify the results using different statistical approaches. The results will allow us to present the data comprehensively. The results of this research may be used to predict the impact of future pandemics or any other possible catastrophes causing institutional closures for lengthy periods on dental education. Our null hypothesis presented is that COVID-19 did not affect pre-doctoral prosthodontic education. The alternative hypothesis presented is that the COVID-19 Pandemic had a negative effect on dental prosthodontic education as defined by the statistical variables.

Methods: This is a cross-sectional study

Methods (Original Research) or Case History/Technical Steps (Case Presentation): No result yet but we will have it by the meeting.

Results (Original Research) or Discussion: Outcome/Follow up (Case Presentation): No result yet but we will have it by the meeting.

Preclinical Virtual Removable Partial Denture Survey and Design

Ms. Ellen George Stewart
University of North Carolina
Predoctoral Dental Student
Current Program Year: Fourth Year

Objectives: To explore student perspectives learning fundamentals of removable partial denture (RPD) survey and design using computer-assisted design (CAD) software.

Methods: Students learned concepts remotely for the preclinical RPD course on digital casts using a software developed by 3PointX. Student feedback on this educational method was gathered using a 13-question Qualtrics survey sent to the UNC DDS Class of 2022. The data was statistically analyzed using Microsoft Excel and assessed using descriptive statistics.

Methods (Original Research) or Case History/Technical Steps (Case Presentation): 87 students participated in the course and designed RPDs on 14 pre-selected and digitized casts.
Of the 41 questionnaire responses, 71% of students indicated they "strongly" or "somewhat" agreed that their education was positively impacted by learning RPD survey and design virtually.
Commonly cited strengths of virtual design included ease of editing, precision of measurements, and speed of workflow. Commonly cited drawbacks included the desire to manipulate casts in their hands, translating this workflow to the student clinics, and the learning curve with the software.
4 (12.1%) students recommended future RPD courses be taught in a strictly digital format, 4 (12.1%) suggested strictly conventional, and the vast majority (75.8%) recommended a combination of digital and conventional formats.

Results (Original Research) or Discussion: Outcome/Follow up (Case Presentation): COVID-19 necessitated a novel way to teach RPD survey and design virtually; utilizing a CAD software program proved to be a successful solution. The majority of student feedback was positive for learning in the digital format. Moving forward, the software can be integrated alongside conventional methods regardless of remote learning requirements to enhance student learning and foster interest in digital workflows.

Incorporating CAD/CAM into Conventional Cast Post & Core Workflow

Dr. Ola Al Hatem
UTHealth School of Dentistry
Prosthodontic Resident
Current Program Year: Third Year

Case Presentation

Objectives: Digital dentistry has facilitated the clinician's daily practice by incorporating new workflows and techniques into conventional procedures, such as cast post and core. The purpose of this case report is to demonstrate the integration of CAD/CAM into cast post and core laboratory procedure.

Methods: In this patient treatment, three post spaces of teeth #8,9,10 were prepared to 8mm and impressed using High viscosity and Ultra LV PVS (Aquasil; Dentsply). The impression was scanned using an intraoral scanner (TRIOS; 3Shape) and the STL file was digitally poured up in Freeware (Autodesk; Meshmixer). The digital models were imported into Exocad DentalCAD (Exocad; GmbH) for design of the post and core patterns.

Methods (Original Research) or Case History/Technical Steps (Case Presentation): The files were sent to the 3D printing software (PreForm Software; Formlabs). Castable Wax Resin (Castable Wax; Formlabs) was utilized with a desktop SLA 3D printer (Form2; Formlabs). The patterns were washed with isopropyl alcohol (99.9 %) for 5 minutes (Form Wash; Formlabs) and invested using the lost-wax casting technique with gypsum investment (Novocast; Whip mix Corp). Burnout of posts was achieved at 13000F for 60 minutes and cast with gold alloy (Firmilay; Argen). Original PVS impressions were poured in ISO Type 5 (Hard Rock Die Stone; Whipmix) and the digitally designed cast post and cores were fitted with minimal adjsutments on the stone cast.

Results (Original Research) or Discussion: Outcome/Follow up (Case Presentation): This report demonstrates the efficiency of incorporating CAD/CAM into the cast post and core fabrication process as well as reducing the risk of locking the pattern into the post space on the master cast.

Digital Approach Utilizing Cone Beam Imaging to Retrieve Screws from Cemented Implant Restorations

Dr. Mustafa Al Tamn
Marquette University
Prosthodontic Resident
Current Program Year: Second Year

Case Presentation

Objectives: To assess the digital approach in screw access retrieval with minimal damage to the cemented implant supported restoration.

Methods: CBCT study ordered Planmeca (Helsinki, Finland), intra-oral scan is acquired utilizing 3Shape (Trios 4, Copenhagen, Denmark), Implant studio (3shape) to design a surgical template supported by the existing implant supported FDP. Identification of brand and dimensions of previously installed implants is performed using previous patient records. Orientation of the virtual dental implants is performed to match the planned implants to existing implants. Th e geometry of the surgical template is drawn on the restorations. Selection of initial pilot drill sleeve (2.0 x 6-mm) Steco (Germany) to locate the screw access.

The final design is approved and exported from implant studio to PreForm segmentation software (Formlabs, Sommerville Massachusetts), the standard tessellation language file is printed using Formlabs 3B printer (Formlabs, Sommerville Massachusetts) using formlabs 3B printer (Formlabs, Sommerville Massachusetts), using Surgical guide resin (formlabs).

Methods (Original Research) or Case History/Technical Steps (Case Presentation): A digital approach to screw retrieval appears to be a clinically acceptable method. Digital planning allows for a conservative estimation of where the screw access path is, limiting the potential fractures of ceramic restorations.

Results (Original Research) or Discussion: Outcome/Follow up (Case Presentation): Advancements in digital technology has increased the accuracy and accessibility of digital technology rendering its use to be common place in a dentist's arsenal.

Fully Digital Workflow for Fabrication of Maxillary Obturator on a Patient with Limited Mouth Opening: A Case Report.

Dr. Noora Almasoodi
Louisiana State University
Prosthodontic Resident
Current Program Year: Second Year

Case Presentation

Objectives: To illustrate the use of a digital workflow for the fabrication of an obturator in a patient with limited opening.

Methods: A 64-year-old female presented with a defect and limited mouth opening (5 mm) caused by a hemimaxillectomy due to a Squamous Cell Carcinoma located at the right side of the palate. The patient had undergone surgical excision and radiotherapy in the maxillary section. Chief complaint: "I want to change my old obturator." A digital scan of both arches and bite registration was made using an intra-oral scanner (Carestream 3600). A CT scan of the patient's interim obturator was made and the DICOM file was converted into an STL file. This file was merged with the intraoral scan STL file to construct the borders of the final obturator. The obturator was designed in Exocad software. The prototype prosthesis was 3D printed (Formlabs). Wrought wire clasp was added to improve retention. The function of the prosthesis was verified by checking the seal of the prosthesis during speech and swallowing function. The lack of nasal regurgitation and vocal nasality indicated that the bulb portion of the prosthesis provided successful obturation.

Methods (Original Research) or Case History/Technical Steps (Case Presentation): A digitally fabricated obturator revealed adequate hard/ soft tissue adaptation with improved esthetics, function, fewer appointments, and eliminate the need of maximum mouth opening for impression.

Results (Original Research) or Discussion: Outcome/Follow up (Case Presentation): Implementing of digital workflows for fabrication of maxillofacial obturators provides an effective method in the construction of a maxillofacial obturator. It minimizes the need for maximum mouth opening and helps to shorten the dental visit for patients.

Rehabilitation of Patient with Maxillary Anterior Teeth Root Resorption and Amelogenesis Imperfecta using a Dual Occlusal Scheme Design

Dr. Danubio Esteban Blen
University of Iowa
Prosthodontic Resident
Current Program Year: Third Year

Case Presentation

Objectives: This clinical case report presents a special treatment modality for a young female patient diagnosed with hypoplastic type of amelogenesis imperfecta. The patient also suffered from incomplete root formation and external root resorption of some maxillary anterior teeth. This condition led to incomplete root formation of the maxillary left canine while the maxillary right canine has a fully formed root. The condition of the maxillary canines presented a challenge to design a mutually protected occlusal scheme involving canine guided articulation on both sides of the mouth.
Methods: The treatment plan involved a full mouth restoration that is planned to give the patient a better occlusal equilibration in which the occlusal disharmony and canine root resorption challenges were managed using two different occlusal schemes. The entire treatment plan was intended to enhance the functional, esthetic and the masticatory components of the masticatory organ.
Methods (Original Research) or Case History/Technical Steps (Case Presentation): A diagnostic waxing was done to reflect two different occlusal schemes based on the different canine teeth root morphology; the left side was designed as a group function articulation while the right side was designed as canine guided articulation. The treatment was executed using the dual occlusal scheme.
Results (Original Research) or Discussion: Outcome/Follow up (Case Presentation): Patient occlusal harmony was achieve by the used of two different occlusal schemes in which esthethics where not compromise.

Conventional vs. Digital Workflow for Anterior-Posterior Rotational Path Removable Partial Denture.

Dr. Brandon Bulloch
University of Maryland
Prosthodontic Resident
Current Program Year: Third Year

Case Presentation

Objectives: This case report describes treatment of a patient presenting with a non-restorable fixed partial denture from #5-11. The retainer teeth were extracted and an interim partial denture was inserted. After healing, diagnostic casts were evaluated and the treatment option for an anterior-posterior rotational path partial was decided upon for the final prosthesis. Conventional and digital workflows were consecutively done to fabricate the metal frameworks. Anterior-posterior rotational path designs are not commonly fabricated in removable labs and the limitations of making such a design digitally was unknown. The workflows were done to compare the ease of fabrication between the methods as well as accuracy of fit of the metal frameworks. The clinical and laboratory steps for each workflow are described and advantages and disadvantages of each workflow are discussed6

Methods: The following methods were done to compare treatment modalities.

1. Conventional impression was made and the design and lab script were sent to a local removable lab.
2. Conventional impression was made and scanned using a digital table scan and sent to a lab that digitally designs partial dentures.
3. A Medit i500 was used to scan patient intraorally and the lab script and intraoral scan was sent to a lab that digitally designs partial dentures.

The workflows were done to compare the ease of fabrication between the methods as well as accuracy of fit of the metal frameworks.

Methods (Original Research) or Case History/Technical Steps (Case Presentation): Pending

Results (Original Research) or Discussion: Outcome/Follow up (Case Presentation): Pending

Utilization of an Impression Matrix for Management of Multiple Abutment Preparations

Dr. Angel Jose Calvo
United States Navy
Prosthodontic Resident
Current Program Year: Third Year

Case Presentation

Objectives: Discussion of a technique to make an impression for conventional fixed prosthodontics, despite inadequate tissue health, on multiple abutment preparations.

Methods: The technique consists on making an impression matrix directly over abutment preparations with a high viscocity bite registration material. Tissue retraction is then achieved similar to the 2 cord technique. The matrix is placed over the cords and hemostatic agent of choice. The larger size cord is removed after adequate contact time. Low viscocity PVS material is injected and the matrix is briefly replaced to gently push impression material into the sulcus. The matrix is removed, more low viscocity material is injected, and the tray is seated with high viscocity material. New provisonal restorations can then be made to improve fit, tissue health, and esthetics.

Methods (Original Research) or Case History/Technical Steps (Case Presentation): The matrix pushes the low viscocity PVS material gently into the sulcus preventing unfavorable collapsing forces that could affect the degree of tissue displacement. Tissue health improved, and final restorations could then be modeled after the provisionals.

Results (Original Research) or Discussion: Outcome/Follow up (Case Presentation): Management of gingival tissue and esthetics are critical to conventional fixed prosthodontics. A goal is to maintain or improve gingival health by minimizing trauma during treatment. Use of an impression matrix may assist when conventional impression techniques do not achieve desired results. (e.g. margin location, tissue health, and multiple abutments.)

Full Digital Workflow for the Treatment of a Patient with Severe Enamel Hypoplasia

Dr. Tintu Sara Chandy
University of Maryland
Prosthodontic Resident
Current Program Year: Third Year
Case Presentation

Objectives: Enamel hypoplasia is a developmental disorder that results in abnormal enamel formation. It can be genetic as in Amelogenesis Imperfecta or due to environmental factors that disturb the normal growth of the enamel organ at any stage of tooth development. Clinically this can result in poor esthetics, increased caries risk, dentin sensitivity, premature pulpal involvement and occlusal wear.

Methods: This case report presents the esthetic management of a 38-year-old male patient with environmental enamel hypoplasia. On examination, there were qualitative and quantitative deficiencies in the enamel of his maxillary and mandibular incisors, canines and first molars. Dark orange-brown bands encircling the teeth were observed with a sharp demarcation between normal enamel apically and abnormal enamel incisally/occlusally. Up to half the clinical crown was involved and affected areas had very thin to absent enamel. Different restorative options were considered, and a fully digital restorative workflow was utilized to restore esthetics using pressed lithium disilicate crowns.

Methods (Original Research) or Case History/Technical Steps (Case Presentation): Pending

Results (Original Research) or Discussion: Outcome/Follow up (Case Presentation): Pending

Novel Approach to Reproducible Rehabilitation of Juvenile with Dystrophic Epidermolysis Bullosa

Dr. Timothy Daudelin
United States Navy
Prosthodontic Resident
Current Program Year: First Year

Case Presentation

Objectives: Dystrophic epidermolysis bullosa (DEB) is an inherited genetic condition affecting collagen in the dermis, causing dermal-epidermal separation. Symptoms include fragile blistering skin/mucosa in response to minor mechanical stimuli. Removable denture prostheses may potentiate DEB symptoms.

Methods: A 10-year-old female with DEB was referred for prosthodontic rehabilitation after extraction of 16 permanent teeth. A CBCT was taken to evaluate possible implant therapy. It was determined that removable prostheses would have a more favorable prognosis.

A manual wax-up/mock-up was first fabricated and tried in. Esthetics, occlusion, and phonetics were acceptable. The initial casts and wax ups were scanned. The prostheses were designed/printed and delivered.

Methods (Original Research) or Case History/Technical Steps (Case Presentation): The patient's growth quickly and significantly changed tooth positions from their original positions. Using the printed prostheses, new impressions were made. The wax up was adjusted, and re-scanned.

Three new prostheses were 3D printed, milled, and manually fabricated for comparison. They were relined intraorally with a long-term soft liner and adequate seating verified.

Results (Original Research) or Discussion: Outcome/Follow up (Case Presentation): In young patients, it may be necessary to replace prostheses every 6-12-months because of continuous growth. Considering the importance of reproducibility, a modified digital workflow was used. Combination of analog and digital technologies allowed for rehabilitation of this patient and permitted reproducibility, with sequential modification, according to her growth.

Fabrication of a Dual Appointment 3-D Printed Definitive Hollow Obturator for a Maxillectomy Defect - Workflow and Pitfalls.

Dr. Karan Handa
University of Manitoba
Prosthodontic Resident
Current Program Year: Second Year

Case Presentation

Objectives: 1. Describe the digital fabrication of a definitive obturator (DO) using 3D printing.

2. Evaluation of prosthesis with regards to patient acceptability, form, function, esthetics, phonetics, and mastication.

3. Difficulties associated and the possible solutions for better integration and success.

Methods: History of current prosthesis- Patient was completely edentulous with a Armany Class II maxillectomy defect in the first quadrant.

- History of conventional complete denture for 3 years with no prosthesis support /extension in the defect area.

Technical steps

First appointment

1. Impressions (Wagner trays); Centric gothic arch tracing and bite registration(AMD trays)

2. Lip support (inbuilt feature in AMD tray), Occlusal plane orientation (AMD ruler) and right mould of teeth (self adhesive aesthetic transparent Guide)

- The records were sent to Avadent. The digital design was selected and communicated online.

Second appointment

1. Extensions and fit (retention, stability and support) of the prosthesis evaluated.

2. Evaluation of esthetics, phonetics and function.

Methods (Original Research) or Case History/Technical Steps (Case Presentation): Outcome

1. Increased retention and stability of the prosthesis by utilization of undercuts in the maxillofacial defect area.

2. Light weight because of hollow design.

3. Instant psychological acceptance of the prosthesis due to markedly improved Speech.

4. Significant cant in occlusal plane of the prosthesis because of lab's inability to integrate the values provided with AMD ruler.

Results (Original Research) or Discussion: Outcome/Follow up (Case Presentation): Although the above-described method provides a faster approach to final prosthesis, there are significant number of technique sensitive steps involved which can affect the final prosthesis. Additionally, a clear line of communication with laboratory is of utmost importance.

Digital Technique for Fabricating Custom Healing Abutments with Native Root-Form Anatomy

Dr. Jeffrey Thomas Hoyle
United States Navy
Prosthodontic Resident
Current Program Year: Third Year

Case Presentation

Objectives: This presentation describes a laboratory technique for fabricating custom healing abutments with native root-form anatomy using a digital workflow. Techniques in common use for fabricating custom healing abutments include direct and indirect methods, but all rely on arbitrary subgingival contours. Previous authors have introduced methods to utilize the subgingival root-form anatomy of a tooth prior to extraction to guide the design of an individualized custom healing abutment. This provides a matrix for soft tissue healing that preserves the native anatomy of the site. These authors have used a variety of software programs and workflows. This technique utilizes an open-source implant planning software and widely-used design program to create individualized custom healing abutments with native root-form anatomy.

Methods: CBCT and scan data of a pre-operative cast were superimposed. A segmentation feature was used to volumetrically delineate a central incisor planned for extraction. Following immediate implant placement, the segmented tooth was imported and aligned with a scanned cast. A custom healing abutment proposal was adapted to the root anatomy of the segmented tooth. Finally, the healing abutment was milled and luted to a stock titanium abutment.

Methods (Original Research) or Case History/Technical Steps (Case Presentation): The primary advantage of this technique is that it preserves the natural subgingival contours of the patient's own anatomy. This may provide more natural esthetics. It also provides a starting point with anatomical references for soft tissue sculpting. However, this technique has some limitations and requires additional planning to execute.

Results (Original Research) or Discussion: Outcome/Follow up (Case Presentation): With proper case selection, this technique may result in superior emergence esthetics of the single-tooth implant restoration.

Retrievable RBFPD for the Exacting Patient

Dr. Marika M. Jagielska
Stony Brook University
Prosthodontic Resident
Current Program Year: First Year

Case Presentation

Objectives: A 74 YO F exacting patient with high esthetic demands presented to the SBSDM prosthodontic clinic unhappy with her interim removable replacement therapy. An Essix retainer replacing tooth #5 could not be used for chewing. The patient had a high smile line which displayed the missing tooth and did not want to remain edentulous during the surgical healing transition period. The Essix retainer was not well tolerated by the patient, therefore, a fixed prosthetic alternative was prescribed.

Methods: The design of the restoration was as follows: A 2-unit cantilever resin-bonded FPD cast in Rexillium III alloy which had maximal palatal coverage on tooth #6. Minimal enamel preparation was performed and the design specified a horizontal loop extending posteriorly from the distal connector to retain a laboratory polymerized composite resin pontic #5. It was important that the pontic was manufactured using a composite resin material, not porcelain, to ease with retrievability of the retainer as the restoration would require retrieval and replacement several times during the surgical treatment. Moreover, as the RBFPD is being retrieved, chipping of the pontic material may be inevitable, but it can be repaired chairside if using composite resin.

Methods (Original Research) or Case History/Technical Steps (Case Presentation): Treatment rationale will be presented with a review of the pertinent scientific literature.

Results (Original Research) or Discussion: Outcome/Follow up (Case Presentation): 2-unit cantilever resin bonded FPD is suitable as an interim restoration replacement therapy.

10th Decade Obturator: Natural Solution

Dr. Rivka Kalendarov
Stony Brook University
Prosthodontic Resident
Current Program Year: First Year
Case Presentation

Objectives: A 90 YO M with a right maxillectomy defect and history of therapeutic H&N radiation completed in 2008, presented with an ailing central incisor (8) and caries secondary to non-compliance with FI carrier therapy. A consult with SBSDM OMFS rendered the tooth unfavorable for extraction despite being hopeless. The patient is at high risk for osteoradionecrosis (ORN) due to his history of cancer, radiation therapy, and advanced age.

Methods: There was a risk of accidental aspiration due to a grade 3 mobility of the tooth. Thus, an alternative treatment, decoronation, was proposed. The mobile tooth was bonded to the adjacent central incisor (9) with composite resin to stabilize and the clinical crown was sectioned from the root with high speed rotary instrumentation. A periapical radiograph demonstrated no periapical radiolucency; therefore no endodontic treatment was rendered. A pick-up impression of the prosthesis completed allowed for reseating the resected natural tooth into the impression. The tooth was added to the existing obturator prosthesis with autopolymerizing acrylic resin (APAR). This resulted in an esthetic outcome matching the contralateral natural central incisor (9). A wrought wire clasp added to the central incisor (9) and a reline of the intaglio surface adjacent the decoronation added to the retention, and stability of the prosthesis.

Methods (Original Research) or Case History/Technical Steps (Case Presentation): A risk of aspiration of a mobile tooth in a cancer patient was resolved by a conservative approach.

Results (Original Research) or Discussion: Outcome/Follow up (Case Presentation): This is a case presentation of an atraumatic interim solution. A new obturator will be fabricated after completion of other restorative treatment.

The use of Milled PMMA Snap on Prosthesis as a Transitional Treatment in a Growing Ectodermal Dysplasia Patient. A Clinical Case Presentation.

Dr. Youssef Kassem
Louisiana State University
Prosthodontic Resident
Current Program Year: Third Year

Case Presentation

Objectives: The purpose of this report is to present a simple and inexpensive solution for growing ectodermal dysplasia patients who suffer from partial anodontia.

Methods: A ten-year-old female presented with her mother (guardian) with the following chief complaint: I want to replace my missing teeth because I am being bullied at school.

After clinical and radiographic evaluation, the patient had teeth #3,A,8,9,J,14 remaining in her upper arch.

A maxillary temporary removable PMMA Snap-On prosthesis that gains its support and retention from the remaining teeth was treatment planned.

After performing minimal enameloplasty on the two maxillary central incisors to have a good path of insertion by reducing heavy undercuts, a digital impression was made using an intraoral scanner and the prosthesis was designed using CAD software and milled in PMMA. The prosthesis was inserted, and the patient was educated on how to insert it, remove it and clean it. The patient understood that the goal of the prosthesis is only for esthetics, not for function.

Methods (Original Research) or Case History/Technical Steps (Case Presentation): Patient and her guardian were highly satisfied with the esthetic and phonetic outcomes of the treatment. The prosthesis and remaining teeth showed no signs of deterioration or complications at 12 months follow up appointment.

Results (Original Research) or Discussion: Outcome/Follow up (Case Presentation): 1- The treatment presented has proven to be a simple and inexpensive solution for esthetic rehabilitation in a growing patient with partial anodontia.

2- It provides an alternative to conventional removable treatments that were inconvenient to the patient and could cause embarrassment.

3- Patient cooperation is crucial for the success of this treatment.

Digital Workflow for Implant Placement/Planning for Overdenture using Dual Scan Technique: Case Report

Dr. Jacqueline Katz
New York University
Prosthodontic Resident
Current Program Year: Third Year

Case Presentation

Objectives: The aim of this case report is to present a dual scan protocol for partially or fully edentulous patients using cone-beam marker stickers and fabrication of a prosthetically-driven printed surgical guide for dental implant placement.

Methods: An extraoral digital scan of a prosthesis with CBCT marker/stickers was superimposed with a scan of a patient wearing the prosthesis for a printed-surgical guide fabrication.

Methods (Original Research) or Case History/Technical Steps (Case Presentation): The dual-scan method allowed more accurate planning.

Results (Original Research) or Discussion: Outcome/Follow up (Case Presentation): Prosthetically driven implant placement using the dual scan method can produce more accurate implant placement.

Managing Prosthetic Complications of Full Arch Fixed Restorations on Zygomatic Implants

Dr. Cara Kennedy
University of Alabama at Birmingham
Prosthodontic Resident
Current Program Year: Third Year

Case Presentation

Objectives: Zygomatic implants introduced by Brånemark in the 1990's may be a solution for patients who have a severely atrophic maxilla. However, these implants often do not achieve the same amount of osseointegration compared to conventional implants. The lack of the bicortical stabilization of the zygomatic implant can lead to micromovement at the prosthetic connection. The mobility at this connection and the increased horizontal bend do not allow for proper stability, resulting in excessive force on the prosthetic components. Although some patients can have additional conventional implants placed to share forces across the arch, this is not always possible.

Methods: A 62-year-old female presented with a maxillary fixed complete denture on zygomatic implants displaying mobility and a history of prosthetic complications including broken abutments and prosthetic screws. The patient's severely atrophic maxilla did not allow for the placement of additional conventional implants. To reduce the excess forces on the prosthetic components, a milled bar with locator attachments was fabricated to support an overdenture, allowing for palatal contact. The locator attachments allow for absorption of excess force during function. Additionally, occlusal discrepancies on the mandibular arch were corrected with full coverage restorations.

Methods (Original Research) or Case History/Technical Steps (Case Presentation): There has been a marked decrease in prosthetic complications and an increase in patient satisfaction since the change of prosthesis from a fixed complete denture to a bar overdenture.

Results (Original Research) or Discussion: Outcome/Follow up (Case Presentation): In cases where there are multiple instances of prosthetic component fracture due to implant micromovement, changing prosthesis design to shift forces away from these components is a suitable treatment option.

Teeth and Scan Body BORNE Surgical Guide for Implant Placement (Technique)

Dr. Lujain Kurdi
Marquette University
Prosthodontic Resident
Current Program Year: Third Year

Case Presentation

Objectives: Introduction

In the terminal dentition, staged extractions and subsequent implant placement is usually used to facilitate transition from a tooth-borne to an implant supported interim prosthesis without the need to wear a removable appliance. Oftentimes, there are not enough remaining teeth to support a tooth-borne surgical guide for placing the remaining implants. In this poster, previously placed and osseointegrated implants were utilized to help fabricate and stabilize the surgical guide and interim prosthesis using a digital approach.

Methods: Technique: 1. Intraoral scan of interim prosthesis in patients mouth, in addition to opposing arch and bite scans. 2. Make an intraoral scan of the prepared teeth before exposing the implants. 3. Following implant exposure, place scan bodies and use intra-oral scanner 4. Aligned maxillary interim and mandibular arch scans using the occlusion. 5. Merge CBCT with the aligned file. 6. Plan remaining implant positions. 7. Fabricate surgical guide on the digital impression obtained using the scan bodies.

Methods (Original Research) or Case History/Technical Steps (Case Presentation): 8. On day of surgery, place scan bodies in the same orientation used during the digital impression appointment. 9. The surgical guide should rest passively on the scan bodies and provide good stability. 10. Implant placement. 11. Temporary cylinders are attached to the interim prosthesis at the osseointegrated implant positions to help orient the interim using a printed cast from the surgical planning file.

Results (Original Research) or Discussion: Outcome/Follow up (Case Presentation): 12. The two new implants were picked up in the milled PMMA interim and immediate loading was achieved (Fig. 16).

A Novel Workflow form Restoration-Driven Implant Positioning to Design of New Dental Prosthesis by Utilizing Surviving Implants

Dr. Yi-Cheng Lai
Indiana University
Prosthodontic Resident
Current Program Year: Third Year

Case Presentation

Objectives: Residual ridge resorption, soft tissue mobility and flap reflection compromise the stability and accuracy of the mucosa-borne surgical templates. This abstract aims to demonstrate how existing implants benefit restoration-driven surgery through accurate positioning and stabilization of the template as well as the following prosthodontic procedures.

Methods: Two plastic abutments for existing implants were incorporated into the mandibular wax denture set-up. After trial insertion, a dual scan protocol was conducted. The fiducial markers used in the scan allowed for merging and segmenting of the two digital volumes before virtual implant positioning of #19 and #30 in coDiagnositX (Straumann AG). Another two virtual implants were programmed to match the alignment of existing implants, which prompted the software to create two drilling accesses for the following pick-up procedure. The surgical template was additively manufactured before the pick-up of transfer copings on the articulated cast.

Methods (Original Research) or Case History/Technical Steps (Case Presentation): Two regular-sized implants were placed adequately with this implant-supported template(s-CAIS). After 8 weeks of uneventful healing, the surgical template was used as an open tray to make the definitive splinted impression and captured the soft tissue form. The planned occlusal arrangement on the template facilitated cross articulation of the cast as well as the design for the bar fabrication.

Results (Original Research) or Discussion: Outcome/Follow up (Case Presentation): Surgical morbidity associated with fixation pins, commonly used in implant surgery for edentulism, can be avoided by utilizing existing implants. The procedure described also provides for restoration-driven implant positioning and simplifying prosthodontic care via cross articulation and transfer of the proposed tooth position, occlusal scheme, and vertical dimension.

Adult Sequalae of Childhood Radiotherapy and Chemotherapy - Get Her Some Teeth!

Dr. Joseph R. Lazaroff
Montefiore Medical Center
Prosthodontic Resident
Current Program Year: First Year
Case Presentation

Objectives: Ewing's sarcoma is a malignant tumor which occurs primarily in children and young adults, often appearing during the teen years. Medical interventions can include chemotherapy, therapeutic radiation and/or ablative surgery. This case report details the selected prosthodontic treatment modalities to provide functional, esthetic, and emotional rehabilitation to an adult patient who received radiation and chemotherapy at a young age.

Methods: A 25 y.o. female patient presented to Montefiore Medical Center for evaluation and treatment having received concomitant radiation and chemotherapy initially at age six. Dental manifestations of this intervention included delayed and partial eruption of her permanent dentition, trismus, along with asymmetrical growth of the rami. The patient had had limited dental intervention at presentation. At initial evaluation it was noted that the existing dentition had not been maintained and missing teeth had not been replaced. Patients chief concerns were impaired masticatory function, unaesthetic appearance, and difficulty phonating. Orthodontic movement of teeth and alveolar segments were contraindicated due to high doses of therapeutic radiation. The patient was subsequently transferred to the prosthodontic program for rehabilitation.

Methods (Original Research) or Case History/Technical Steps (Case Presentation): Pending

Results (Original Research) or Discussion: Outcome/Follow up (Case Presentation): Pending

Laboratory and Clinical Considerations Associated with the Health and Esthetics of the Peri-implant Soft Tissue.

Dr. Farheen Malek
Louisiana State University
Prosthodontic Resident
Current Program Year: Second Year

Case Presentation

Objectives: To evaluate the dental material related factors affecting health and esthetics of peri-implant soft tissues.

Methods: An electronic literature search was conducted on soft-tissue health and esthetics related to different abutment materials and abutment design, color, surface characteristics and treatment. The biological response and esthetics of soft tissues with different abutment design, material, color, surface modification was studied.

Methods (Original Research) or Case History/Technical Steps (Case Presentation): For long term success of dental implants and prostheses, the health of surrounding alveolar bone and soft tissue is essential. The epithelial and connective tissue attachment surrounding the implant–soft tissue has been demonstrated to provide a biological barrier of the alveolar bone from the oral environment. The peri-implant soft tissue health is dependent on several factors including implant-abutment interface, the loading pattern, material and design of the abutment, surgical procedure, and oral hygiene. In literature, the role of different abutment material and design changes has been reported to have a significant impact on biological response of tissues. Histologic studies showing the improved fibroblast adhesion to modified abutment surfaces and hence improved soft-tissue seal can be considered in the selection of abutments. The soft-tissue phenotype, biological and optical properties of abutment material significantly affect the esthetics of the peri-implant soft tissues.

Results (Original Research) or Discussion: Outcome/Follow up (Case Presentation): The clinical and laboratory factors related to dental materials can improve the peri-implant soft tissue health and esthetics.

A Systematic Approach to the Retrieval of a Damaged Implant Abutment Screw.

Dr. Rodney Martin
United States Navy
Prosthodontic Resident
Current Program Year: Third Year

Case Presentation

Objectives: Dental implants provide a wide range of treatment options to restore form and function. Risks of dental implants as a long-term treatment, however, remain. These include biological and mechanical complications. Among mechanical complications, a stripped abutment/prosthetic screw head is an event that many restorative practitioners may encounter. The purpose of this poster is to outline a systematic method for retrieval of a stripped implant abutment/prosthetic screw using commonly available equipment.

Methods: Retrieval of a damaged implant abutment/prosthetic screw begins with assessment, both tactile and radiographic. If able to rotate, or if radiographically indicated, one may assume there is a fracture of the screw or damage to the screw threads; retrieval using ultrasonic vibration may prove useful. If unable to rotate, however, then it is possible there is a stripped screw head. In this case, a slot may be created in the screw head. A dimple is first made in the center of the head, and verified with adequate lighting and magnification. A new slot is then created with a bur. The screw can be retrieved with a flat tip, or otherwise modified, driver.

Methods (Original Research) or Case History/Technical Steps (Case Presentation): Successful retrieval of a damaged implant abutment/prosthetic screw may take place with appropriate assessment, and careful technique.

Results (Original Research) or Discussion: Outcome/Follow up (Case Presentation): Fractured abutment or prosthetic screws are possible mechanical complications with dental implants. Creating a modified screw head may allow retrieval of a stripped implant abutment/prosthetic screw.

Which came first? The Abutment or Screw Fracture...

Dr. Jennifer Mehrens
Stony Brook University
Prosthodontic Resident
Current Program Year: Second Year

Case Presentation

Objectives: More than 5 million implants are placed each year for the purpose of replacing missing teeth. While the majority result in successful treatment, biological, technical, and esthetic complications occur at rates ranging from 3.5%-8.8%. Commonly reported complications include soft tissue issues, bone loss, screw-loosening, loss of retention, and fracturing of veneering material. Less frequently, abutment or screw fractures have been reported with a cumulative incidence of 0.35% after 5 years of follow up. This case report aims to highlight a rare clinical outcome and explore possible etiology of prosthetic failure.

Methods: 62 YO M presented to PG Prosthodontic Program with a chief concern of "I want to fix my teeth." A treatment plan for full mouth rehabilitation included extraction of hopeless teeth and a combination of tooth- and implant-supported fixed restorations. A Biohorizons 3.8mm x 9mm implant was placed in a healed #3 site. Second stage surgery was completed 8 months later and 12 months later the implant was loaded with a provisional screw-retained implant crown. Definitive restoration was placed another 3 months later and torqued to 30 Ncm.

Methods (Original Research) or Case History/Technical Steps (Case Presentation): After six months of function, the patient presented with his implant-supported, screw-retained, single metal ceramic crown #3 dislodged from the oral cavity. Upon evaluation of the fractured components, it was revealed that both the abutment screw as well as the abutment connection had fractured.

Results (Original Research) or Discussion: Outcome/Follow up (Case Presentation): Results on failure mode pending but will be included in this report. It will also document the method of metallurgic analysis.

Prosthodontic Management of Esthetic Implant Complication: A Case Report

Dr. Esha Mukherjee
University of Louisville
Prosthodontic Resident
Current Program Year: Third Year

Case Presentation

Objectives: Esthetic implant complications can occur due to a combination of biologic, prosthetic, and iatrogenic factors. The need for prosthetic or surgical intervention depends on the nature of failure and patient specific characteristics like tooth display and smile line. This case represents a successful prosthetic management of an esthetic implant failure.

Methods: 32 y/o CF reported with a failing Maryland bridge from #9-11. Patient had congenitally missing #7 and #10 for which she received implants in 2001. #10 implant was removed within 4 years due to failure. Two unsuccessful attempts were made to graft this site with autogenous graft. Radiographic examination showed that these surgical interventions caused 80% bone loss around #9 and 11. Subsequent removal and replacement with implants were planned at #9 and 11 site without bone augmentation due to history of failed grafts and eventually #8 was removed and replaced with an implant.

Methods (Original Research) or Case History/Technical Steps (Case Presentation): A 5-unit monolithic zirconia implant FDP was delivered, with cantilever on #7 and pontic at #10. Overall, the patient was pleased with the esthetics and no complications were noted at 3 and 6 month follow up.

Results (Original Research) or Discussion: Outcome/Follow up (Case Presentation): Prosthetic management of esthetic implant failure was possible in this case due to the patient's low smile line and reasonable esthetic demand. However, inadequate planning can often result in unesthetic results and may need aggressive surgical interventions. Appropriate treatment planning and material selection are key factors in success of implant restorations.

A Clinical Protocol for Immediate Implant Placement and Provisionalization of Adjacent Implants in the Esthetic Zone: A Case Report

Dr. Olivia M. Nguyen
Harvard University
Prosthodontic Resident
Current Program Year: Third Year

Case Presentation

Objectives: The replacement of adjacent teeth in the esthetic zone with implants can pose significant esthetic challenges. The subsequent bone and soft tissue changes following extraction and implant placement can result in mid-facial gingival recession and loss of inter-implant papilla height. This clinical report describes a clinical protocol for immediate implant placement and provisionalization of two adjacent implants with the goal of maintaining the existing soft tissue architecture.

Methods: A 37 year old female presented with secondary caries under full-coverage, all-ceramic restorations in the anterior maxilla. Clinical assessment determined that extraction and immediate placement of single endosseous implants were indicated for the maxillary central incisors. Atraumatic extraction of the central incisors was completed and preservation of buccal bone was confirmed. Adjacent implants were placed into maxillary central incisor extraction sites and immediately provisionalized. The peri-implant soft tissue changes over the first 8 weeks post-operatively were evaluated through digital means to analyze the volumetric changes that took place over this period. To achieve optimum esthetics, final restorations were fabricated with all-ceramic materials.

Methods (Original Research) or Case History/Technical Steps (Case Presentation): Volumetric analysis revealed minor loss of soft tissue volume in the inter-implant papilla as well as the mid-facial region from the pre-operative situation, with insignificant esthetic consequences.

Results (Original Research) or Discussion: Outcome/Follow up (Case Presentation): In cases where the pre-existing soft tissue architecture is ideal around the teeth to be replaced, an immediate implant placement and provisionalization protocol may be an option to better maintain the soft tissue.

Case report: a Digital Workflow for Digitally Designing and 3D Printing of a Surgical Crown Lengthening Guide

Dr. Yi Ren
University of Louisville
Prosthodontic Resident
Current Program Year: Third Year

Case Presentation

Objectives: This poster presents a digital workflow for digitally designing and 3D printing of a surgical crown lengthening guide.

Methods: Fisrt, I prepared the patient's maxillary teeth and made a set of chairside provisonals according to the diagnostic wax up. Second, I obtained a maxillary Cone Beam CT (CBCT) of my patient with the provisionals to determine the osseous level and ensure that there is no violation of biologic width. Third, utilizing the 3Shape software, I created a digital smile design based on the wax up. The digital smile design provides a clear view of final gingival margin to help plan the final osseous margins. Fourth, I imported the CBCT stl file into the 3Shape software and aligned the intraoral scan of chairside provisionals to the CBCT. Fifth, we aligned the digital smile design to the intraoral scan of the chairside provisionals based on the palatal soft tissue within the 3Shape software.

Methods (Original Research) or Case History/Technical Steps (Case Presentation): From the overlap photo of the CBCT with the surgical guide, I identified that this patient needed crown lengthening on #3 through #6.

Results (Original Research) or Discussion: Outcome/Follow up (Case Presentation): Traditionally, a diagnostic wax-up is used to determine final tooth and soft tissue contours and some type of splint is used to communicate with the surgeon for any soft tissue and bone reduction needed. Current technology in digital design allows for the development of a smile design for crown contours and esthetics, these designs can be registered with a current CBCT image to determine the amount of soft tissue and bone reduction needed to maintain biological width.

Battle of the Bands: Grayson-NAM vs. DynaCleft Taping

Dr. Alexa Schweitzer
Montefiore Medical Center
Prosthodontic Resident
Current Program Year: Third Year

Case Presentation

Objectives: Presurgical nasoalveolar molding is a technique recognized to be advantageous in the treatment of cleft lip and palate (CL&P) patients. Repositioning the alveolar segments to reduce the size of the cleft combined with soft tissue molding of the nares allows for more favorable surgical outcomes. This is ideally initiated within the first week of life to take advantage of the increased levels of hyaluronic acid present at birth which makes the cartilage and tissues particularly malleable. This tapers off postnatally making NAM increasingly difficult with baby aging.

The current gold standard for NAM is the Grayson method introduced in 1993, which uses an intraoral appliance and nasal stent. In 2013, the DynaCleft taping system was introduced as an alternative to the Grayson method, which uses extraoral positioning strips and nasal elevators. Comparative studies have shown the effectiveness of both methods to be similar in the treatment of unilateral CL&P.

Methods: This case presentation documents treatment of an eight-week-old Hispanic male with bilateral CL&P. Prior to his presentation at Montefiore Medical Center, no treatment had been rendered. Given the size of the defects and patient's age, a combined therapeutic approach was taken using concepts from Grayson-NAM and DynaCleft systems.

Methods (Original Research) or Case History/Technical Steps (Case Presentation): Positive results were obtained using this combined therapy approach that have significantly improved the prognosis for this patient's primary lip-nose repair.

Results (Original Research) or Discussion: Outcome/Follow up (Case Presentation): The alveolar bone and surrounding tissues were still adequately moldable at this stage. With proper patient selection, a combined therapeutic approach can produce favorable outcomes.

The Use of a Combined Analog/Digital Workflow for the Fabrication of a Complete Maxillary Denture: A Clinical Report.

Dr. Heidar O Shahin
Louisiana State University
Prosthodontic Resident
Current Program Year: Second Year

Case Presentation

Objectives: The objective of this report is to describe an effective analog/digital 2-visit workflow for the fabrication of a complete maxillary denture opposing natural dentition.

Methods: The patient presented with a defective maxillary complete denture, fabrication of a new prosthesis was needed.

On the same visit, the existing denture was used as a tray for the final impression. Baseplate wax was added to the denture teeth to slightly increase the vertical dimension of occlusion and the occlusal relationship was registered. After pouring the impression, the mounted casts and denture/wax rim assembly were scanned with a laboratory scanner. The existing denture was later retrieved, cleaned, and returned to the patient, and the master cast was scanned and merged with the existing files. Articulated files were imported to the design software for the prosthesis design. The base and teeth were 3D printed separately, bonded together, finished and polished.

On the second visit, the denture was tried in, slightly adjusted as needed and delivered. The patient was allowed to "test drive" the prosthesis for some weeks before the final fabrication of the milled PMMA prosthesis.

Methods (Original Research) or Case History/Technical Steps (Case Presentation): The patient was satisfied with the efficient, 2-appointment treatment, as well as the esthetic and functional outcomes. The accuracy and fit of the 3D-printed denture were clinically acceptable.

Results (Original Research) or Discussion: Outcome/Follow up (Case Presentation): This workflow has proven to be efficient in combining analog and digital procedures to deliver a 3D-printed denture in a short period of time. However, future material development will be important for a more esthetic, stable, and possibly biocompatible long-term outcome.

Maxillary Arch Rehabilitation in Cleft Palate Retreatment: A Case Report

Dr. Apurwa Shukla
University of Illinois at Chicago
Prosthodontic Resident
Current Program Year: Third Year

Case Presentation

Objectives: A 32-year female patient presented with a loose maxillary complete denture. She has difficulty with retention, speaking, eating, and drinking. The objective of this case to restore esthetics and function.

Methods: A comprehensive evaluation revealed a repaired cleft lip & palate, and the nasal tip deviated to the right. Intraorally, a 5mm oronasal communication was closed on the anterior palatal midline.CBCT revealed a repaired large cleft palate between 7, 8 with inadequate maxillary bone extending posteriorly. To address the unfavorable anatomic conditions supporting denture use, a CAD/CAM denture prototype and radiographic stent were produced. Following CBCT dual scan imaging, a surgical guide was produced to provide a graftless surgical approach to overcome marked anatomic restrictions. Five maxillary implants were placed with primary stability and a CAD/CAM immediate load. The final restoration was fabricated using the Co-Cr milled metal framework substructure and monolithic milled acrylic teeth bonded to the framework.

Methods (Original Research) or Case History/Technical Steps (Case Presentation): Anatomic restrictions, including pneumatized sinuses, existing hydroxyapatite graft materials, and reduce restorative dimension, were identified and managed in the digital planning environment.The use of guided surgery simplified challenging implant placement, and the associated CAD/CAM immediate prosthesis was used to guide the final prosthesis design. The restricted restorative dimension was managed by the use of a Co-CR material and metal occlusal design in the second molar position. The maxillary anterior prosthesis/alveolar ridge contact was easily managed to reduce air escape and improve phonetics.

Results (Original Research) or Discussion: Outcome/Follow up (Case Presentation): Working in the digital environment, using alternatively tilted implants, and selecting appropriate materials provided solutions to the presented challenge.

A Case Presentation Utilizing a Hybrid Digital Process to Manufacture Surveyed Milled Zirconia Crowns and a Conventional RPD.

Dr. Gaurav Singla
University of Manitoba
Prosthodontic Resident
Current Program Year: Third Year

Case Presentation

Objectives: Monolithic zirconia surveyed crowns were fabricated for a bilateral cleft lip and palate patient with residual fistulas to help retain his cast partial upper denture/ obturator.

Methods: Abutment teeth were prepared for full coverage zirconia crowns and final impressions were made and poured in type IV stone. Dies were pindexed and trimmed after mounting with a CR record. Individual crowns were wax up on these dies and surveyed following original design proposal. Using an Omnicam, prepared abutments were scanned followed by models of opposing arch and bite record. Surveyed wax ups of the crowns were scanned in the Biogeneric copy function to get a proposal to the mill zirconia crowns in presintered form. After milling, sprue was removed and the rest seats and guide planes were accentuated in the green state and the crowns were sintered. The final crown contours were confirmed, polished, occlusion checked and characterized and glazed and delivered with resin cement. The RPD was then fabricated conventionally.

Methods (Original Research) or Case History/Technical Steps (Case Presentation): Monolithic restorations for surveyed crowns are not only stronger and reduce incidence of chipping and fracture of veneering porcelain that was seen in porcelain fused to metal crowns; but they can be more esthetic as well since there is no metal that will show through.

Results (Original Research) or Discussion: Outcome/Follow up (Case Presentation): This case presentation provides an alternative to producing surveyed monolithic restorations with chair side intraoral scanner and inhouse milling unit.

Digitally-Driven Esthetic Rehabilitation for Hutchinson's Incisors

Dr. Kelly M. Suralik
Mayo Clinic
Prosthodontic Resident
Current Program Year: Second Year
Case Presentation

Objectives: This case report discusses the interdisciplinary and digitally-driven oral rehabilitation of a patient with congenital syphilis.

Methods: Congenital syphilis presents with pathognomonic features including ocular interstitial keratitis and eighth nerve deafness. Dentally, altered formation of both the anterior and posterior teeth, referred to as Hutchinson's incisors and mulberry molars respectively, can occur. Abnormal tooth morphology such as widening of the middle third of the crown, short clinical crown height, and hypoplastic notch on the incisal edge is present.

Methods (Original Research) or Case History/Technical Steps (Case Presentation): Oral manifestations are rare, but require collaborative, multidisciplinary approach to restorative care.

Results (Original Research) or Discussion: Outcome/Follow up (Case Presentation): In this case, computer-aided design-computer-aided manufacturing (CAD-CAM) and additive manufacturing were utilized to plan and support periodontal surgical procedures and tooth-supported prosthodontic rehabilitation to restore a patient with compromised smile esthetics due to Hutchinson's incisors.

Guided CAD/CAM Custom Provisional Immediate Healing Abutment, Direct and Indirect Technique.

Dr. Georgi Talmazov
UTHealth School of Dentistry
Prosthodontic Resident
Current Program Year: Third Year

Case Presentation

Objectives: Using 3D modeling software, Blender, and implant software, Blue Sky Plan, digital diagnostics were completed and restorations designed. Custom healing abutments were 3D printed along with a uniquely designed novel "carrier splint."

Methods: Case #1: using direct method and involving a non-restorable #11. An immediate implant treatment was planned using CBCT merged with IO scan. The position was established, and a surgical guide designed and exported with DICOM segmentation of #11. In Blender a root-form healing abutment design was made with a corresponding carrier splint. The 3D printed root-form provisional was picked-up on a provisional abutment post-implant placement using the splint.

Case #2: using indirect method and involving a missing #8 with the presence of diastema that will be closed. A fully guided protocol was followed for implant placement and #9 prepared for an indirect restoration. For provisionalization at second stage surgery, using CAD, a two-piece provisional restoration was fabricated. The prosthetic components were 3D printed and using the carrier splint concept the position picked up indirectly on an altered cast. The provisional implant crown was modeled using digital smile design and cemented separately with IRM, due to a facially oriented screw access.

Methods (Original Research) or Case History/Technical Steps (Case Presentation): The outcomes of both cases showed that the "carrier splint" concept is a reliable technique that can provide for clinically predictable CAD generated custom provisional solutions.

Results (Original Research) or Discussion: Outcome/Follow up (Case Presentation): This concept allowed for the transference of the digitally designed component's unique timing and position information into analog form. Directly or indirectly, the prosthesis can be picked-up predictably using this carrier.

Use of 3D Reconstruction Image from 2D Picture for Esthetic Analysis – A Case Repot

Dr. Nassif Youssef
Boston University
Prosthodontic Resident
Current Program Year: Third Year

Case Presentation

Objectives: In this case report we will be discussing steps for 3D esthetic analysis using Inlab software and the IOS to provide a more combined view of the facial scan and jaw scans of the patient.

Methods: Virtual smile design has been used widely by dentists to perform esthetic analysis of their patients. There are 2 ways to achieve the virtual smile design, either 3D reconstruction of the patient 2D images or using a 3D facial scanner. Once 3D image was created intra oral scanner(IOS)'s image could imported in the 3D facial image.

Methods (Original Research) or Case History/Technical Steps (Case Presentation): The limitation of the 3D facial scanner is their cost. Alternative 3D reconstruction from 2D images has been widely used through dental CAD software due to less cost and ease of capturing 2D images. It is available in most of dental CAD software.

Results (Original Research) or Discussion: Outcome/Follow up (Case Presentation): -Using this technique helped the patient have realistic expectation of where treatment can go and improve her current condition as well as help clinician assess and make best clinical judgment.

Assessment of Accuracy and Reliability of Shade Selection Using an Intraoral Scanner

Dr. Krupa Bambal
New York University
Prosthodontic Resident
Current Program Year: Third Year
Original Research

Objectives: The aim of this study is to assess the accuracy of shade selection of an intraoral scanner (IOS).

Methods: 16 shade tabs (B1, B2, B3, B4, A1, A2, A3, A3.5, A4,C1, C2, C3, C4, D2, D3 & D4) from the Vita Classic shade guide will be scanned 10 times each on the middle third of the facial surface. A TRIOS 3Shape (Copenhagen, Denmark) intra-oral scanner will be used and a Vita Classic shade guide will serve as control. All shade scans and selections will be conducted in a windowless room using full spectrum lighting between 5500 and 6000 kelvin and a Color Rendering Index (CRI) of at least 90. One operator will perform all scans.

The intra-oral scanner software will then evaluate the scan and provide a shade. The scanned output will be labeled as "1" for a correct match and "0" for an incorrect match.

Methods (Original Research) or Case History/Technical Steps (Case Presentation): The null hypothesis is that there will be no difference in shade accuracy between the intra-oral scanner and the control. Results will be determined based on completion of data collection and statistical analysis.

Results (Original Research) or Discussion: Outcome/Follow up (Case Presentation): The conclusion will be provided in the full poster presentation.

Occlusion Guidelines for the Completely Edentulous Implant Patients.

Dr. Marco Bergamini
University of Washington
Prosthodontic Resident
Current Program Year: First Year
Original Research

Objectives: One criterion for long-term success of implant supported restorations is the establishment of a proper occlusal scheme. It is imperative for clinicians to be well versed with the different concepts when rehabilitating with an implant prosthesis. The importance of occlusion is oftentimes neglected due to limited understanding and lack of available data from the literature. The aim of this research is to provide guidelines for clinicians to successfully restore occlusion for edentulous implant patients using recommendations from the literature.

Methods: An electronic search was performed in several databases including PubMed, Cochrane, and Scopus. The key words were "implant occlusion", "implant occlusal scheme" , "implant overload", "implant complications".

Methods (Original Research) or Case History/Technical Steps (Case Presentation): A decision-making tree according to type of restoration and the opposing arch has been formulated. Anterior guidance when opposing natural dentation with lighter contact in the anterior is suggested. For tissue borne removable prostheses, it is advised to provide a bilateral balanced occlusion while for implant borne removable prostheses, it is recommended to provide the patient with canine guidance or group function occlusal scheme. For a fixed complete denture, a canine guidance or group function is suggested. [PENDING UPDATE]

Results (Original Research) or Discussion: Outcome/Follow up (Case Presentation): Selection of a correct occlusal scheme is important for the long-term success of the implant borne prosthesis.

Does the Waxing Impression Technique Distort the Final Impression?

Dr. Kuan-Ming Chiu
University of Southern California
Prosthodontic Resident (Graduated June 2021)
Current Program Year: Other
I graduated in June 30 2021, which is within 6 months before this ACP annual meeting

Original Research

Objectives: The waxing impression technique, which Mojmir Vacek first described in 1965, is a modification of the final impression before pouring the stone cast. The procedure uses melted adhesive wax to thicken the skirt of impression material around the margin in order to define the preparation finishing line more clearly. This step also protects impression material from being torn when separating the stone cast. However, the wax shrinkage from molten to solid-phase may present a risk of impression distortion. This study aims to investigate the absence or presence of distortion of the impression after applying the waxing impression technique.

Methods: Three typodont teeth were prepared, scanned, and a standard model was printed out. Ten PVS impressions were made from this standard model. The Sticky wax was used for the waxing impression technique in five of the impressions as the experimental group. The scanned STL files of impressions before and after applying the wax were obtained by a lab scanner. The GOM Inspect Suite software was used for surface comparison. The other five impressions were scanned twice as the control group. The paired-t test was used to show the overall deviations. Two-way ANOVA was used to distinguish the difference between different measuring points.

Methods (Original Research) or Case History/Technical Steps (Case Presentation): Statistically significant differences existed among the experimental and control group ($P<0.0001$). When comparing different measuring points, significant differences showed only in mesial and distal points.

Results (Original Research) or Discussion: Outcome/Follow up (Case Presentation): Within the limits of this present study, the waxing impression technique does distort the final impression. Clinicians and technicians should apply this procedure with caution.

Dental Implant Treatment Outcome and Impact on Patients with Oligodontia and their Parents

Dr. Ciu Ciu
University of Toronto
Prosthodontic Resident
Current Program Year: Second Year
Original Research

Objectives: Oligodontia affects patients' oral health-related quality of life (OHRQoL) by weakening chewing and speech, undermining cosmetics and social well-being. Dental implants result in substantial functional and psychosocial improvements, but therapy is lengthy, complex, and costly. The patient's voice on the treatment and the impact on their lives and their parents is rare. We use a qualitative research method to explore patients' views of dental implant treatment and the impact on their lives and their parents.

Methods: This study involves 15 semi-structured telephone interviews with English-speaking patients affected by oligodontia aged 18-25 years who received a dental implant-supported prosthesis more than three months prior. Eleven of these patients' parents are interviewed independently. The interviews are audio-recorded and transcribed verbatim. Data are collected and coded following the principles of qualitative thematic analysis.

Methods (Original Research) or Case History/Technical Steps (Case Presentation): Both groups reported difficulties in diagnosing oligodontia, understanding the treatment plan, and access to appropriate care. Youth are unaware of dental issues in early childhood until the emotional challenge starts in middle school. Youth rely heavily on parents and dentists for making an informed treatment decision. Family members were the primary resource of support throughout treatment. The complicated treatment process affects patients not only physically but also emotionally and socially. The financial liability is often a burden to patients' families. However, patients' OHRQoL is improved significantly by treatment, and both groups reported high satisfaction with the treatment outcome.

Results (Original Research) or Discussion: Outcome/Follow up (Case Presentation): Considering the complexity of treatment for young patients with oligodontia, assessing dental implant treatment outcomes based on the patient's view is necessary.

MDP-Mediated Adherence to Rapid-fired Zirconia - a Fracture Mechanics Approach

Dr. Mai EL Najjar
University of British Columbia
Prosthodontic Resident
Current Program Year: Third Year

Original Research

Objectives: Introduction: The success of all-ceramic restorations depends on strong and stable bonds to dental hard tissues, achievable by adhesive cementation. For zirconia-based restorations, 10-methacryloyloxydecyl dihydrogen phosphate (10-MDP) is a suitable primer. Adherence to zirconia imparted by 10-MDP has been investigated with shear and micro-tensile bond strength tests. Objective: This study aims to apply fracture mechanics methodology to investigate the effect of 10-MDP on the adherence of a resin composite luting agent (RCLA) to rapid-fired zirconia (RFZ).

Methods: Materials & Methods: Interfacial fracture toughness (IKIC) was determined with the notchless triangular (NTP) specimen KIC test. Nighty six NTP specimens were cut and ground from RFZ (Katana) blocks, followed by rapid firing. The samples were then cut into halves and allocated to three groups, each with a different surface preparation protocol prior to bonding: Control, no treatment; MDP, 5 % 10-MDP ethanol primer; Silane, Bisco Bis-Silane. All samples were bonded with a RCLA (3M RelyX Veneer Cement) and stored in water at 37 °C. After 24 h storage, half of the specimens from each group were tested to determine the IKIC; the remaining specimens will be tested after 90 d storage. Scanning electron microscopy fractographic analysis was performed on representative fractured samples from each group. Statistical analysis of the results is pending.

Methods (Original Research) or Case History/Technical Steps (Case Presentation): Result: At 24 h, the MDP group had a significantly higher IKIC; samples from the other two groups debonded before testing. For MDP group, crack propagation occurred cohesively through the RCLA. The 90 d tests are pending.

Results (Original Research) or Discussion: Outcome/Follow up (Case Presentation): Pending

Effect of Accelerated Aging on Shear Bond Strength of Two Generations of Zirconia

Dr. Polyxeni Konti
Louisiana State University
Prosthodontic Resident
Current Program Year: Third Year
Original Research

Objectives: To evaluate the effect of accelerated aging on shear bond strength of translucent zirconia (5Y) and conventional zirconia (3Y).

Methods: Square zirconia samples were cut from 5Y (Katana UTML) and 3Y (Katana ML) zirconia discs and sintered according to the manufacturer's instruction. Samples were divided into 3 subgroups including control, 5 hours of aging, 200 hours of aging. Accelerated aging was performed by autoclaving samples at 134°C under 0.2 MPa of pressure. Surface was air abraded with alumina particles for 10 seconds under 2 bars of pressure. After application of ceramic primer (Clearfill ceramic primer), tygon tubes filled with resin cement (Panavia V5) were placed on the surface and light cured for 40 seconds (n=10 per group). After 24 hours of storage at 37°C, shear bond strength value (MPa) was measured using a universal testing machine at cross head speed of 1 mm/min. Two-way ANOVA and post-hoc Tukey's tests were used to examine the effect of aging and zirconia type on bond strength. Statistical tests were two-sided and significance level was set at 95% (α=0.05).

Methods (Original Research) or Case History/Technical Steps (Case Presentation): Shear bond strength of 3Y and 5Y samples prior to aging (control groups) were similar ($p>0.05$). After aging for 5h or 200h, bond strength of 3Y samples was significantly lower than the 5Y specimens with similar aging periods ($p<0.05$).

Results (Original Research) or Discussion: Outcome/Follow up (Case Presentation): Type of zirconia had significant influence on effect of accelerated aging on shear bond strength values; while aging did not change the bond strength to 5Y zirconia samples, it reduced the bond values in 3Y samples.

Accuracy of Digitally-Designed RPD Framework Fit: A Literature Review

Dr. Adam Lakhani
New York University
Prosthodontic Resident
Current Program Year: Third Year
Original Research

Objectives: Rapid manufacturing is an additive method of fabrication, whereas milling is subtractive. The aim of this review was to assess the accuracy of the current CAD/CAM fabrication methods for removable partial dentures with the conventional lost-wax fabrication method.

Methods: An electronic search was conducted using the PubMed/MEDLINE, ScienceDirect, and ResearchGate databases from 1985 to 2021. The search was performed using keywords including CAD/CAM, design, partial dentures, framework, RP, rapid manufacturing, accuracy, fit, and milled. Forty-three articles were collected from the search and reviewed in full-text format. Twelve articles were selected to be included in this study as being most relevant to the objectives. The null hypothesis is that there will not be a difference in the accuracy of fabrication and fit between the different CAD/CAM methods with the conventional lost-wax fabrication method.

Methods (Original Research) or Case History/Technical Steps (Case Presentation): The results of the review were that milled fabrication produced the best framework fit. The rapid manufacturing with partial digital workflow had an acceptable degree of fit but may not be as accurate as casting with a wax burnout pattern. Selective laser melting was also shown to be a viable option producing an acceptable fit but still inferior to conventional casting.

Results (Original Research) or Discussion: Outcome/Follow up (Case Presentation): The most accurate removable partial denture framework can be produced with an entirely digital workflow. Milling was shown to have the best fit.

The Effect of Varying UV polymerization Methods on the Fracture Load of 3D-printed Provisionals

Dr. Alan Meskin
New York University
Prosthodontic Resident
Current Program Year: Third Year
Original Research

Objectives: Digital dentistry, through the advent of CAD/CAM imaging and milling systems has greatly impacted restorative dentistry and prosthodontics in particular. While dentistry can benefit greatly from 3D-printing, there have been few studies that address the effects of UV polymerization on the fracture load of 3D-printed prostheses. The objective of this study is to compare the fracture load of 3D-printed provisional prostheses cured with varying UV post-polymerization times.

Methods: This bench lab study used a metal master model to prepare two abutment teeth, a first premolar, and a second molar. A 4-unit provisional restoration was digitally designed. 45 provisionals were 3D-printed and divided into 3 groups based on different polymerization times to perform a three-point bending test.

Methods (Original Research) or Case History/Technical Steps (Case Presentation): An ANOVA test will be used to determine statistically significant differences. The null hypothesis is that there will be no difference in fracture load between the prostheses.

Results (Original Research) or Discussion: Outcome/Follow up (Case Presentation): The conclusion will be provided in the full poster presentation.

Effects of Various Surface Treatments and Cement Types on Tensile Bond Strengths of Cements to Three Zirconia Materials

Dr. Hoon Min
United States Air Force
Prosthodontic Resident
Current Program Year: Third Year

Original Research

Objectives: To evaluate the effects of various surface treatments and cement types on the tensile bond strength (TBS) of cements to three zirconia materials.

Methods: Three zirconia materials (KATANATM Zirconia HTML, STML and UTML), 135 specimens each, were divided into three surface treatment groups: no air abrasion (NO), air abrasion with glass beads (GB) and air abrasion with aluminum oxide (AL). For each group, printed resin (Formlabs Grey Resin) was cemented to zirconia specimens using three cement types: RelyXTM Luting Plus (RXL), RelyXTM Unicem 2 (RXU) and PANAVIATM V5 (PAN). A total of 405 cemented specimens (27 groups, N=15/group) were stored in distilled water at 37 ℃ for 24 hours and tested for TBS. All specimens were inspected to determine failure modes. Data were analyzed with Kruskal-Wallis and Mann-Whitney U tests (α=0.05).

Methods (Original Research) or Case History/Technical Steps (Case Presentation): RXL showed the lowest median TBS of all three zirconia materials, which was statistically different from RXU and PAN irrespective of surface treatments (P<0.05). RXL exhibited mostly adhesive failures including pre-test failures. For HTML, RXU with AL surface treatment showed the highest median TBS (P<0.05). For STML, RXU with AL and PAN with GB or NO surface treatment had significantly higher median TBS than the other groups (P<0.05). For UTML, RXU with AL and PAN with AL, GB or NO surface treatment showed significantly higher median TBS (P<0.05) than the other groups.

Results (Original Research) or Discussion: Outcome/Follow up (Case Presentation): Cement types had significant effects on TBS. RXL performed significantly less than RXU and PAN. Performance of RXU and PAN varied depending on zirconia materials and surface treatments.

Evaluation of the Shear Bond Strength of Reline Materials to Three Types of Denture Resin Materials

Dr. Bahareh Moradi
NOVA Southeastern University
Prosthodontic Resident (Graduated June 2021)
Graduated less than 6 months
Current Program Year: Other
recently graduated (June 2021)

Original Research

Objectives: Objectives: The objective of this in vitro study is to compare shear bond strength of four different denture base resin materials, fabricated by different techniques, to two different reline materials with and without conditioner.

Methods: Methods: In this study two printable (Next Dent Denture 3D+ and Next Dent C&B MFH), one milled (Original Denture Base-Universal from Avadent), and one heat processed (Lucitone 199) denture base resins were studied. In total 192 samples were made as 20 mm x 20 mm x 3 mm plates. The reline materials of choice Jet Tooth Shade as PMMA base material and Quick Up as composite base material were bonded to the plates in a cylinder shape with or without applying SR Connect (Ivoclar Vivadent) conditioner. After thermocycling the shear bond strength was measured by a universal testing machine. After data collection, the statistical analysis was done using ANOVA followed by Tukey HSD adjustment. Also, the fracture mode was evaluated under stereo microscope.

Methods (Original Research) or Case History/Technical Steps (Case Presentation): Results: The strongest bond was seen between NextDent Denture Base 3D+ and Quick Up followed by milled denture base (Original Denture Base-Universal) bonded to Jet acrylic. The weakest bond was between Lucitone 199 Denture Base and Quick Up. Printed materials had the strongest bond to Quick Up. SR connect significantly decreased the bond between printed denture base and Quick Up.

Results (Original Research) or Discussion: Outcome/Follow up (Case Presentation): Conclusions: both conventional and milled denture bases had higher shear bond strength with resin base reline material, and printed materials had better performance with composite base reline material.

Three-Dimensional Accuracy of Implant Placement Related to the Use of Dynamic Navigation Compared to Fully Guided and Conventional Implant Placement Using an Out-of-bounds Guide

Dr. Alyssa-Joy Oviatt
United States Air Force
Prosthodontic Resident
Current Program Year: Third Year

Original Research

Objectives: This study compares the accuracies of dynamic navigation (DN), fully limiting static guide (FG), and out-of-bounds guide (OG) modalities for implant planning and placement.

Methods: A master mandibular model had six implants placed. This model was used to plan the implant locations using the three modalities. A single operator prepared osteotomies and placed 120 implants in 20 experimental models, five models per group (DN right clip, DN left clip, FG, OG). Post-placement cone beam tomography was performed on each model and compared to the master model. Errors in angle deviation, entry point deviation, and apex deviation were recorded and analyzed.

Methods (Original Research) or Case History/Technical Steps (Case Presentation): DN and FG were more accurate than OG with respect to angular deviation ($P<0.001$), entry point deviation ($P=0.001$), and apex deviation ($P<0.001$) errors. DN was more accurate than FG in angular deviation ($P<0.001$, DN: 1.27° ± 0.63, FG: 2.00 ° ±1.08). FG was more accurate in entry point deviation ($P<0.001$, DN: 0.66 mm ± 0.32, FG: 0.46 mm ± 0.34). No significant difference was found between DN and FG for apex deviation ($P<0.001$, DN: 0.67 mm ± 0.43, FG: 0.80 mm ± 0.33).

Results (Original Research) or Discussion: Outcome/Follow up (Case Presentation): DN exhibited lower angular errors than FG and OG and was more accurate than OG regarding entry point deviations and apex deviations. DN was not inferior to FG in apex deviation. With comparable accuracy to FG, DN is a promising technology in the field of implant surgical planning and guidance.

Bond Strength of Different Self-Adhesive Resin Cements to Zirconia

Dr. Nupur Patel
University of Pennsylvania
Maxillofacial Pros Fellow (Pros Completed June 2021)
June 2021 Prosthodontics residency graduate, current Maxillofacial Pros Fellow
Current Program Year: Other
Original Research

Objectives: The purpose of the study was to compare the shear bond strength of five self-adhesive resin cements used to bond zirconia.

Methods: Seventy-two Zirconia specimens were sectioned and sintered in an induction furnace. Specimen surfaces were cleaned with ultrasonication in alcohol followed by air particle abrasion. Cylindrical composite resin specimens were bonded to the zirconia samples with self-adhesive resin cements Panavia SA Universal (PSA), TheraCem (TCM), SpeedCem 2.0 (SCM), RelyX Unicem 2 (RCM), PermaCem 2.0 (PCM) and dual-cure multi-step composite resin cement Panavia V5 (control, PV5, after application of ceramic primer). A load of 1000 g was applied during bonding, then light cured for 80 s. Samples were subjected to 10,000 thermal cycles. Shear bond strength was determined using a universal testing machine expressed in MPa. The fractured surfaces were inspected with a stereo microscope.

Methods (Original Research) or Case History/Technical Steps (Case Presentation): Shear bond strength values [MPa] were for PSA 8.64 (1.78 SD), TCM 9.05 (2.64 SD), SCM 8.54 (1.92 SD), RCM 7.60 (1.26 SD), PMC 7.59 (1.10 SD) and PV5 9.59 (1.55 SD). One-way ANOVA test revealed no statistically significant differences in shear bond strength between the resin cements tested ($p>0.05$). Pair wise comparison using Tukey test revealed that the shear bond strength using RCM was statistically lower than that using PV5 ($p<0.05$).

Results (Original Research) or Discussion: Outcome/Follow up (Case Presentation): Self-adhesive resin cements can achieve shear bond strengths to zirconia that are comparable multi-step resin cements. Self-adhesive resin cements can be a user- friendly, less technique sensitive alternative for bonding Zirconia restorations following the APC concept.

The Accuracy of Post and Core Fabricated with Digital Technology

Dr. Tarin Piangsuk
University of Iowa
Prosthodontic Resident (Graduated June 2021)
Current Program Year: Other
Graduated June 30th 2021

Original Research

Objectives: The purpose of this research was to compare the accuracy of post and core created with three different fabricating techniques; direct conventional, milling and three dimensional printing.

Methods: Thirteen extracted single root central incisors were selected. Root canal treatment and tooth preparation for crown were performed on all teeth. Eleven millimetres post space preparation was created using prefabricated fiber post drill. Impression was made on root canal and three dimensionally scanned. The scanned impressions were used to design digital post and cores. The digitally designed post and cores were used to fabricate 3D printed and milled resin patterns. The same teeth were used to fabricate post and core with direct conventional technique. All posts were then scanned before cast using base metal alloy. The metal post and cores were tried in and adjusted until found to be seated on abutment teeth. Volume measurement of scanned post and core were done using digital software to determine accuracy.

Methods (Original Research) or Case History/Technical Steps (Case Presentation): The adjusted metal post and core fabricated with three different techniques showed no statistical different in accuracy. The accuracy of 3D printed resin pattern was found to be inferior compare to milled resin pattern. However, dimensional stability of the 3D printed resin pattern before and after casting was found to be superior to milling resin pattern and direct resin pattern. All three techniques showed significant volume reduction after adjustment

Results (Original Research) or Discussion: Outcome/Follow up (Case Presentation): These findings revealed that digitally fabricated post and core has the same degree of accuracy as the gold standard direct conventional post and core fabrication technique.

Maintenance of Initial Manufacturer Recommended Abutment Screw Torque of a Carbon Fiber Screw Within a 2-piece Screw Retained Zirconia Implant Connection After Fatigue Testing

Dr. William Randi
Manhattan VA Post Graduate Prosthodontics
Prosthodontic Resident
Current Program Year: Third Year

Original Research

Objectives: The purpose of this study is to evaluate the maintenance of the initial manufacturer recommended abutment screw torque of a carbon fiber screw within a 2-piece screw retained zirconia implant connection from Nobel, after fatigue testing and compare it to a titanium screw connection, manufacturer "Neoss" (control).

Methods: A pilot study comparing the fatigue resistance of Straumann's and Nobel's two peice zirconia implant abutment connections was already compeleted by the current Author and compared to Neoss's conventional titanium implant abutment connection.

The test load (240 N) was predetermined in the pilot study to ensure samples will run out at 1 million cycles Testing will follow ISO guidelines 14801. Implants (NobelPearl Tapered RP 4.2x12mm, ref# 300757) will be embedded into a brass sleave and cemented with a metal-epoxy glue. Implants will be fitted with prefabricated abutments (NobelPearl Abutment Straight, inter-x RP 1mm, ref# 300664), and torqued with a carbon fiber screw to 25Ncm. A hemispherical test cap will then be fitted to the abutment, however, to gain access to the retaining screw after testing the test cap will not be cemented to the abutments. The test specimens will be affixed in a universal loading machine and loaded at 2Hz for 1 million cycles in isotonic saline at 37 °C ± 2 °C. After which the removal force (N) of the carbon fiber screw will be measured. Scanning electron microscopy will be done on the retaining screws pre and post testing.

Methods (Original Research) or Case History/Technical Steps (Case Presentation): NA

Results (Original Research) or Discussion: Outcome/Follow up (Case Presentation): NA

Comparison of Dimensional Changes of 3D-printed Provisionals with Varying Polymerization Times: An Invitro Study

Dr. Amanda Samaan
New York University
Prosthodontic Resident
Current Program Year: Third Year

Original Research

Objectives: The aim of this study is to compare the effect of different post-curing methods of 3D printed provisionals on dimensional changes.

Methods: A metal master model was prepared with two abutment teeth for the first premolar and molar to fabricate a 4-unit provisional restoration. The master model was scanned using a Medit i500 intraoral scanner and a provisional prosthesis was designed with four markers.

45 samples are printed in a MoonRay S DLP 3D printer and randomly assigned into three groups: Group 1- 30 min polymerization, Group 2 -15 min polymerization, and Group 3 - 60 min polymerization. Each group with 15 samples was 3D-printed using NextDent. All samples were polymerized in a UV lightbox.

All provisionals were scanned with the Medit i500 intraoral scanner and saved as electronic stereolithography (.stl) files. Each .stl of the scanned provisionals was superimposed on the .stl of the control provisional using Medit Compare software.

Methods (Original Research) or Case History/Technical Steps (Case Presentation): pending completion of data collection

Results (Original Research) or Discussion: Outcome/Follow up (Case Presentation): pending completion of data collection

Post-insertion Complications of Digital Complete Denture Systems: A Literature Review

Dr. Lakshmi Senkumar
New York University
Prosthodontic Resident
Current Program Year: Third Year
Original Research

Objectives: Digital dentures have gained popularity because of the reduced number of clinical appointments without compromising the overall quality of the final prosthesis. The aim of this literature review was to assess the post-insertion complications associated with digital complete dentures.

Methods: An electronic search was conducted using Pubmed/MEDLINE, Cochrane, and ResearchGate databases from 2000 to 2021. The search was performed using keywords "digital dentures complications", and "CAD/CAM dentures complications". The search yielded 197 articles in English which were reviewed by title. 17 articles that investigated CAD/CAM denture complications were selected. The null hypothesis is that there is no difference in the type of post-insertion complications with digital dentures.

Methods (Original Research) or Case History/Technical Steps (Case Presentation): Based on the limited published evidence, patient dissatisfaction, inadequate retention, and inadequate esthetics were the most common complications associated with digital dentures.

Results (Original Research) or Discussion: Outcome/Follow up (Case Presentation): Digital dentures are a viable option for treating complete edentulism. However, more studies need to be done to evaluate the post-insertion complications of digital complete denture systems.

The Effect of Torque and Sterilization on the Vertical and 3D Displacement of Scan Bodies with Varying Compositions

Dr. Michael Simon
Stony Brook University
Prosthodontic Resident
Current Program Year: Third Year
Original Research

Objectives: The objectives of this study were to evaluate the effect of torque application and sterilization on the vertical and 3D displacement of three scan body systems.

Methods: One Ti-6Al-4V implant was embedded into an acrylic model simulating the mandible. Forty-five multi-use scan bodies: fifteen PEEK, fifteen PEEK with a titanium base, and fifteen titanium, were placed onto the implant. A digital impression of each scan body was made using a 3Shape Trios intraoral scanner. Subsequently, the scan bodies were torqued down to the values recommended by the manufacturers and re-scanned. Then, each scan body underwent one sterilization cycle and a new set of digital impressions were made. This process repeated for a total of ten sterilization cycles. Measurements of vertical and 3D displacement were made using Geomagic software.

Methods (Original Research) or Case History/Technical Steps (Case Presentation): Pending

Results (Original Research) or Discussion: Outcome/Follow up (Case Presentation): Pending

Invitro Analysis of Monomer Leaching in Modern Dental Materials: CAD Milled vs. Printed vs. Traditional Heat and Cold Processed Denture Base Resins

Dr. Greta R. Smidt
University of California, Los Angeles
Prosthodontic Resident
Current Program Year: Third Year

Original Research

Objectives: The purpose of this study is to evaluate the ratio of residual monomer in materials being used for denture bases: CAD milled polymethyl methacrylate (PMMA), printed denture base resin, heat-processed PMMA and cold-cure processed PMMA comparatively.

Methods: Milled, printed, heat-activated and autopolymerizing denture base specimens (n=3 for each group, each test run 3 times) were fabricated according to manufacturer recommendations. Specimens were immersed in chloroform, an organic solvent, to evaluate monomer leaching and to observe physical properties of the materials. NMR-spectroscopy was used to evaluate dissolution of materials and to evaluate residual monomer to crosslinked polymer ratios at 1-day, 4-days, and 9-days. A second group of specimens were then immersed in D_2O to evaluate if residual monomer would leach out of the system. The solution was then analyzed using NMR spectroscopy for one month.

Methods (Original Research) or Case History/Technical Steps (Case Presentation): While the heat-processed, cold-cured and milled specimens possessed residual monomers, no significant monomer leaching was noted in the printed specimen, while immersed in chloroform-d. Similarly, the printed specimen was most resistant to dissolution, as compared to the rest (dissolution of specimen is indicative of little to no cross-linking). No detectable dissolution of monomer was seen for all specimens when immersed in D_2O for up to one month.

Results (Original Research) or Discussion: Outcome/Follow up (Case Presentation): Residual monomer is not found in the printed denture material in this study in either chloroform-d or D_2O, where as CAD-milled and traditionally processed denture bases still have residual monomers within their respective systems when immersed in organic solvent. None of the specimens tested leached monomer into D_2O.

Value Characteristics of Veneered Porcelain on Polychromatic Zirconia

Dr. Jeremiah Jason Sparks
United States Navy
Prosthodontic Resident
Current Program Year: Third Year
Original Research

Objectives: To determine if value-retaining fluorapatite glass ceramics maintain the color value of restorations when veneered to polychromatic zirconia substructures with increased yttria concentrations.

Methods: A full contour monolithic polychromatic zirconia restoration was designed and 0.8mm cutback applied. One full contour polychromatic ziconia restoration (shade A3) was milled, sintered, and glazed. Four cutback restorations of the same restorative material were milled and sintered. Two of the cutbacks were veneered with standard fluoroapatite glass ceramic, and glazed. The other two were veneered with fluoroapatite glass ceramic on multi-translucent zirconia and glazed. Each sample was measured with a chairside photospectrometer at the incisal, middle, and cervical. Each corresponding master shade tab was measured and compared.

Methods (Original Research) or Case History/Technical Steps (Case Presentation): The monolithic polychromatic zirconia restoration had the lowest measured color value of the five samples. The two value-retaining fluorapatite veneered restorations had the highest measured values of the five samples.

Results (Original Research) or Discussion: Outcome/Follow up (Case Presentation): Value enhancing fluorapatite glass ceramic veneered to zirconia using higher concentrations of yttria may result in a lighter shade, or higher color value, restoration.