

A Novel Zwitterion Incorporated Nano-Crystalline Ceramic and Polymer for Bacterial Resistant Dental CAD-CAM Block

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I. Objective

To create bacteria-resistant dental computer-aided design and manufacturing (CAD-CAM) blocks with a biofilm-resistant effect by incorporating Nano-crystalline ceramic and polymer (NCP) with 2-methacryloyloxyethyl phosphorylcholine (MPC) and sulfobetaine methacrylate (SBMA) and at an equimolar ratio, referred to a MS.

II. Materials & Methods

NCP blocks without MS served as control (CTRL) and experimental groups comprised NCP blocks containing zwitterions at 0.15wt% (MS015) and 0.45wt% (MS045). The flexural strength was determined in accordance with ISO standard 6872 and the microhardness samples were evaluated using Vickers hardness testing (MMT-X, Matsuzawa Seiki Co., Tokyo, Japan) equipped with a Vickers diamond indenter having a load of 200 g and a dwell time of 10 s. Additionally, water sorption and solubility measurements were performed according to ISO 4049 and light transmittance and light irradiance were measured using milled blocks. To assess the cytotoxicity of each sample, cytotoxicity was evaluated using human gingival fibroblasts (HGF) cells. Finally, the resistance to single and multi-species bacterial adhesion was investigated.

III. Results

MS045 showed significant reduction in flexural strength ($P < 0.01$) compared to both CTRL and MS015. Both MS015 and MS045 showed significantly increased water sorption and significant reduction in water solubility compared to CTRL. Light transmission remained consistent across all MS content levels, but the irradiance value decreased by 12 % in the MS045 group compared to the MS015 group. Notably, compared to the CTRL group, the MS015 group exhibited enhanced resistance to adhesion by *Porphyromonas gingivalis* and a multi-species salivary biofilm, with biofilm thickness and biomass reduced by 45 % and 56 %, respectively.

IV. Conclusion

NCP containing 0.15wt% MS can effectively reduce adhesion of multiple species of bacteria while maintaining physical and mechanical properties. NCP integrating zwitterions is clinically advantageous in resisting bacterial adhesion at internal and external margins of milled indirect restoration.

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Bonding performance of self-adhesive resin cement using zirconia primer

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I. Objective

In this study, we aimed to evaluate the bond strength of self-adhesive resin cement containing MDP to zirconia, considering the application of a zirconia primer and the effects before and after thermocycling.

II. Materials & Methods

In this study, 180 sintered zirconia blocks ($10 \times 10 \times 15$ mm³) were sequentially polished with silicon carbide (SiC) paper up to #1,000 grit, then sandblasted with 50 μ m aluminum oxide at a pressure of 0.25 MPa for 15 seconds. The blocks were divided into six groups based on three types of self-adhesive resin cements (Theracem [TC], Clearfil SA Luting [SA], and Rely-X U200 [RU]) and the application of a zirconia primer (Z-Primer Plus) or no primer. Each resin cement was bonded to the zirconia surface using an Ultradent jig (diameter: 2.38 mm). Half of each group was stored in distilled water at 37°C for 24 hours, while the other half underwent 10,000 thermocycles between 5°C and 55°C before measuring shear bond strength with a universal testing machine (n=15). Failure modes were analyzed using an optical microscope, and fracture surfaces were observed with a SEM. To measure the physical properties of the resin cements, specimens were prepared using $2 \times 2 \times 25$ mm³ molds, and flexural strength was measured after 24 hours and after 10,000 thermocycles. Surface hardness (Vickers hardness) was measured on resin cement specimens with a diameter of 10 mm and a height of 6 mm under the same conditions (n=16). The results were analyzed using three-way and two-way ANOVA, with post-hoc Tukey tests conducted at a 95% confidence level.

III. Results

According to the three-way ANOVA analysis, there was no interaction between the resin cement type, primer application, and thermocycling ($p > 0.05$). However, there were statistically significant differences depending on the type of resin cement, the presence of primer, as well as before and after thermocycling. The initial and post-thermocycling bond strengths followed the order of TC > SA > RU ($p < 0.05$). All experimental groups showed significantly higher shear bond strength with the application of the zirconia primer ($p < 0.05$). Bond strength significantly decreased in all groups after thermocycling ($p < 0.05$). Premature failures before shear bond strength measurement were observed in group RU and SA. Fracture mode analysis indicated that mixed failure modes predominated, regardless of the resin cement or primer application. Flexural strength and surface hardness were highest in group RU, followed by group TC and SA ($p < 0.05$), and group RU maintained higher values after thermocycling ($p < 0.05$).

IV. Conclusion

The self-adhesive resin cement containing MDP and calcium silicate demonstrated superior bonding performance for zirconia restorations, which was further enhanced with the application of a zirconia primer.

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Clinical Effectiveness of CAD/CAM Lithium Disilicate Block in Class II Inlay Restoration : a Randomized Controlled Trial

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I. Objective

The purpose of this randomized controlled clinical trial is to evaluate and compare the clinical effectiveness of two lithium disilicate CAD/CAM blocks (Amber Mill; Hass, Korea and e.max CAD; Ivoclar Vivadent, Liechtenstein) in class II inlay restoration.

II. Materials & Methods

This study was a randomized, double-blind clinical trial, and followed the CONSORT (Consolidated Standards of Reporting Trials) statement. Based on inclusion and exclusion criteria, 36 patients who had two proximal caries-affected teeth were included and received class II CAD/CAM ceramic inlay on each tooth. Each restoration was designed with CEREC software (Dentsply Sirona, Germany) and manufactured by CEREC MC XL (Dentsply Sirona, Germany) milling machine. One was made with Amber Mill and the other was made with e.max CAD according to the allocation table. The restorations were etched with hydrofluoric acid, silanized, and cemented with resin cement (Rely-X Ultimate, 3M ESPE, US). During follow-up periods, the restorations were independently evaluated by two examiners during regularly scheduled maintenance appointments according to the FDI criteria. Primary endpoint was fracture and retention of material, and secondary endpoints were surface luster, surface and margin staining, color and translucency, esthetic anatomical form, marginal adaptation, radiographic examination, patient's view, postoperative sensitivity, recurrence of caries, periodontal response and adjacent mucosa. Statistical analysis was carried out with SPSS 23 software (IBM, Chicago, USA). The material groups for each category were compared using the Mann-Whitney test.

III. Results

Among the 36 participants, 35 patients with 70 restorations were evaluated 1 year after the intervention. There were two failures in e.max CAD and one failure in Amber Mill. No significant difference was found in each evaluation category of FDI criteria between two materials.

IV. Conclusion

Within the limitations of this study, Amber Mill showed comparable results with e.max CAD in CAD/CAM class II inlay restoration.

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Space Closure Using Putty index and Pre-contoured Matrix

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I. Objective

Diastema is a space or gap between two adjacent teeth what is a common esthetic concern that can negatively affect a patient's satisfaction with their smile. Direct resin restoration is one of treatment options to close space which is non-invasive and cost-effective. In direct resin filling, putty index method through wax-up provides favorable palatal and incisal form of desired final restoration. However, in narrow space, it can be difficult to create the palatal shell and manipulate the instruments to create the appropriate emergence profile. Pre-contoured Bioclear matrix (Bioclear, USA), recently introduced to diastema closure, is easier to get proper emergence profiles using this matrix. This case report presents the space closure with direct resin restoration using conventional putty index method and Bioclear matrix depending on the size of the space.

II. Case Presentation

1. Sex/Age : F/41
2. Chief Complaint (C.C) : There is a space between my upper front teeth. I want to close the space.
3. Present Illness (P.I) : #11,21,22 : per(-) air(-) mob(-) EPT(+) pain(-)
4. Impression : Spacing on #12^11^21^22
5. Treatment plan : Space closure with direct composite resin on mesial space of #21 with putty index, and distal space of #11, mesial space of #22 with Bioclear matrix

III. Conclusion

In space closure with direct composite resin, each method of restoration has its advantages. Putty index method defines palatal contour and form, incisal line angles of desired final restoration. Bioclear matrix is easier to get proper proximal contours and emergence profiles by simply applying resin to the teeth with the matrix placed into the sulcus.

In this case, 2.5mm mesial space of #21 was restored with putty index method, 0.5mm distal space of #11 and 1mm mesial space of #22 were restored with a Bioclear matrix. When using Bioclear, a proper emergence profile was obtained with simple and short process, even in narrow space where it's hard to apply a restoration instruments. However, in large space, it was difficult to maintain the matrix with only wedges, and it could require additional polishing to make proper incisal line angle and palatal form. It was more useful to restore with the putty index in that space because it facilitated restoration of forms similar to adjacent teeth.

When restoring the space with direct composite resin, clinicians can select an appropriate method in consideration of various circumstances, such as the size of the space.

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Management of Dens evaginatus with reversible pulpitis

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I. Objective

Dens evaginatus (DE) is a dental anomaly with a supernumerary tubercle projection that typically contains dentin and pulp tissue. DE teeth with reversible pulpitis should be managed by early prophylactic management to preserve tooth vitality. Clinical prep-and-fill technique can be performed to block the pathway of bacterial ingress and to allow pulp healing. If pulp exposure occurs during procedure, DPC(Direct pulp capping) or RCT(Root canal Therapy) is needed. In this clinical case, no pulp exposure was observed after grinding the tubercle and DE teeth was treated with indirect pulp capping.

II. Case Presentation

<Case I>

1. Sex/Age : F/26
2. Chief Complaint (C.C) : I have a bite pain on right mandibular premolar. (Onset : 2WA)
3. Present Illness (P.I) : Dens evaginatus on #44, P/R(+), Bite(+), Rest(-), EPT(+9, ref : #45, +10)
4. Impression : Dens evaginatus on #44
5. Treatment plan : #44 Direct or Indirect pulp capping & Direct Restoration

III. Conclusion

The DE(Dens evaginatus) teeth with reversible pulpitis should be managed early by tubercle excision and proper pulpal protection and management. The prep-and-fill technique is typically recommended to preserve tooth vitality with /without pulp capping. According to the classification of DE teeth by Oehlers et al.(1967), isolated pulp horn remnants in which the pulpal compartment in the tubercle separated from the main pulp chamber (type D) accounts for 20% among whole DE teeth. In this case, isolated pulp horn remnants were observed, and no pulp exposure occurred after grinding down the tubercle. Therefore, indirect pulp capping was performed using Theracal LC to promote calcific bridge formation beneath the capping material. Calcific bridge formation and pulp recession can be evaluated by periodic radiograph. Proper pulpal diagnosis and appropriate treatment approach is important in managing DE teeth.

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Maxillary anterior space management with no-prep laminate veneers

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I. Objective

The no-prep approach for veneers have been introduced recently as part of the development of minimally invasive dentistry. Porcelain laminate veneers without tooth preparation (no-prep veneers) might represent a convenient and conservative option for the esthetic rehabilitation of anterior teeth. However, controversy exists about their predictability. This case report presents a case of no-prep porcelain veneers placed as per the recently proposed “CH no-prep” protocol, which claimed to overcome many of the drawbacks of previous no-prep veneer solutions.

II. Case Presentation

<Case I>

1. Sex/Age : F/19
2. Chief Complaint (C.C) : I want to fill the space of my upper anterior teeth
3. Present Illness (P.I) : ^#12, #11^21, #22^ spacing, #12,11,21,22 per(-) bite(-) mob(-) cold(WNL) normal pocket depth
4. Impression : #12,11,21,22 normal pulp/normal apex, diastema
5. Treatment plan : Space closure with Porcelain laminate veneers on #12,11,21,22

III. Conclusion

No-prep laminate veneers have might offer clinical advantages, including maximum preservation of sound tooth structure, optimal bonding to enamel, and a potentially complete reversibility in case of removal and reintervention. However, the no-prep approach for veneers has been also questioned because of over-contoured and poor-quality margins and alteration of the emergence profile. With careful case selection, these non-invasive veneers present a compelling option for space closure, offering a balance of esthetics, durability, and minimal alteration. The case reports show that properly managed no-prep veneers can have biologically healthy and aesthetically pleasant tooth-restoration transitions

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Considerations for Replacing Multiple Old Diastema Closure

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I. Objective

Diastema occurred by various reasons may harm the appearance of a smile. Many options are suggested for treating diastema including orthodontics, restorative dentistry, and prosthodontics. Among them, restorative approach is considered to be the fastest, most conservative, and most economical way to fix diastema. However, fixing the gap using composite resin free handed requires professional skill of the operator. Also to mimic the natural dentition, there are many considerations one should take into account such as the proportion of the tooth, proportion between the teeth, and gingival papilla. When multiple teeth are involved, achieving satisfying result gets far more complicated. In this case, after careful treatment planning with dental impression, replacement of multiple old diastema closure was done by using putty index as a guide.

II. Case Presentation

<Case I>

1. Sex/Age : Female/
2. Chief Complaint (C.C) : My old resin restoration seems unesthetic due to discoloration and I want to replace it.
3. Present Illness (P.I) : #11, 12, 21 per(-) ice(+) mob(0)
4. Impression : #11, 12, 21 diastema
5. Treatment plan : #11, 12, 21 impression taking, wax up, resin restoration using putty index

III. Conclusion

In this case, Patient wanted the treatment to be conservative as possible. Therefore, among the many treatment options, method of direct restoration involving the fabrication of silicon putty index was chosen. Due to restoration done in the past, the exact size of the gap between the teeth could not be measured. Assuming the shape of the tooth, preparation was done on the dental model. Aside from the diastema between the central incisors there was a gap between #11 and #12 also. Since there was no gap on the counterpart there was a high risk that the patient's smile would seem asymmetrical. So, careful analyzation of the tooth proportion was done before the wax up. Using putty index and Mylar strip, direct restoration by Estellite opaque resin (AO3), 3M-Filtek resin (A3) was done, bonded by Clearfil-SE Bond.

The patient's esthetic expectations were successfully met through a conservative approach consisting of direct resin bonding. The presence of multiple diastemas in anterior teeth is one of the challenges of clinical esthetics dentistry, and to reach a satisfying result, careful treatment planning should be done.

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Restoration of maxillary anterior tooth with a subgingival fracture using orthodontic extrusion in an elderly patient

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I. Objective

Treatment of crown-root fractures can be challenging due to fracture margins being close to the alveolar bone crest and insufficient tooth structure. Orthodontic extrusion, surgical extrusion or crown lengthening can be used as treatment options to achieve an adequate biologic width and ferrule effect, leading to the successful restoration of extensively fractured teeth. Orthodontic extrusion can be used to increase the clinical crown length or as a method for implant site development, especially in the aesthetic zone. In this case study, orthodontic extrusion was used for restoration of maxillary incisor with crown-root fracture.

II. Case Presentation

< Case >

1. Sex/Age : Male/82
2. Chief Complaint (C.C) : I broke my upper tooth while eating. Since I'm already undergoing implant treatment, I don't want any additional procedures that involve removing a tooth.
3. Present Illness (P.I) : #22 crown-root fracture with pulp exposure (fracture margin located labial 2mm subgingival), per(+) mob(-) ice(+)
4. Impression : #22 complicated crown-root fracture
5. Treatment plan : #22 root canal treatment, post, core and zirconia crown after orthodontic extrusion

III. Conclusion

Orthodontic extrusion is a non-invasive treatment option that can prevent the need for tooth extraction in cases of fractured teeth. This method has lower risks of damaging gingival aesthetics and periodontal health compared to other alternative methods, making it preferable in the aesthetic zone for all age groups. By exposing the fracture margin above the gingival sulcus, an acceptable crown-root ratio of 1:1 can be achieved, along with sufficient tooth structure (at least 1.5mm from the margin) to provide the ferrule effect. Through orthodontic extrusion, the restoration of compromised teeth can be accomplished, thereby improving the longevity of the tooth.

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Aesthetic rehabilitation of a subgingivally fractured maxillary anterior teeth with orthodontic extrusion: A case report

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I. Objective

Subgingivally fractured anterior teeth present a challenge in dental treatment, especially among older patients where conventional extraction and prosthetic solutions may not be ideal. This case report aims to evaluate the viability of orthodontic extrusion as a conservative treatment approach for subgingivally fractured anterior teeth in older adults.

II. Case Presentation

1. Sex/Age : Female/68
2. Chief Complaint (C.C) : My anterior tooth was broken while I was eating dried persimmon.
3. Present Illness (P.I) : #22 Crown-root fracture with pulp exposure (1mm subgingival fracture line)
air(-) per(-) mob(-) EPT(-) pain(-)
4. Impression : Crown-root fracture with pulp exposure
5. Treatment plan : Root canal treatment and orthodontic extrusion

III. Conclusion

Restoration of subgingivally fractured teeth is difficult. In this case, after treatment, the tooth has remained functionally and aesthetically stable without significant issues. The tooth treated by orthodontic extrusion harmonizes well with the surrounding periodontal tissues, resulting in an aesthetically pleasing outcome. This approach is conservative, as it preserves the tooth rather than opts for extraction. Additionally, maintaining the alveolar bone in the esthetically critical maxillary anterior region offers advantages for future implant placement if extraction becomes necessary. Considering these factors, orthodontic extrusion can be a rational and aesthetically favorable treatment option for managing subgingivally fractured anterior teeth in older patients.

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Fiber-Reinforced Composite Resin Bridge Restoration for Periodontally Hopeless Teeth

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I. Objective

A periodontally hopeless tooth with severe bone resorption, mobility, and abnormal tooth migration is often extracted. Various treatment options are available for replacing a missing tooth, such as implant-supported restorations, fixed partial dentures (FPD), or removable partial dentures (RPD). However, if the crown-to-implant ratio is not favorable, the risk of failure may increase, and if there is significant mobility of adjacent teeth, RPDs are inappropriate. Additionally, in the case of FPDs, the amount of tooth reduction required on adjacent teeth may be excessive. A fiber-reinforced composite resin (FRC) bridge with a natural tooth pontic can be an alternative method to replace missing teeth.

II. Case Presentation

<Case I>

1. Sex/Age : M/68
2. Chief Complaint (C.C) : My lower anterior teeth is loose and it's uncomfortable
3. Present Illness (P.I) : #31 per(-), mob(++), #41 mob(+++)
4. Impression : #31,41 cemental tear, #41 root fracture
5. Treatment plan : #31,41 extraction, FRC bridge using #31,41 as pontics

III. Conclusion

This case presentation reports the use of a fiber-reinforced composite resin (FRC) bridge with a natural tooth pontic to replace missing teeth. FRC bridges require minimally invasive preparation of adjacent teeth, which results in less tooth sensitivity and a lower risk of caries. They also require fewer visits and are more cost-effective. Additionally, using a natural tooth pontic provides the highest esthetic results and excellent biocompatibility with the oral environment. FRC materials enhance the bonding strength to the tooth structure, improving the retention of restorations and enhancing the mechanical properties of the resin, making it more resistant to fracture and wear. An FRC bridge with a natural pontic can be considered a viable treatment option for replacing an extracted anterior tooth due to periodontal disease.

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Esthetic Resin Restoration of Fractured Anterior Tooth

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I. Objective

Crown fracture of maxillary anterior teeth is common traumatic dental injury and can cause esthetic and functional problems. Fragment reattachment, crown restoration or direct composite resin restoration are the possible treatment options for fractured anterior teeth.

The development of adhesive bonding and resin materials has enabled more conservative and quick direct esthetic restoration. In general, direct composite resin restoration of fractured teeth is considered successful when the shade and anatomy are well restored.

In this case report, natural layering technique and prefabricated silicone putty index are used for restoring anatomy and shade.

II. Case Presentation

<Case I>

1. Sex/Age : M/67
2. Chief Complaint (C.C) : I fell over while riding a bicycle and broke my anterior tooth. I don't think the tooth position has changed. I just feel a little tenderness on the broken tooth.
3. Present Illness (P.I) : Crown fracture without pulp exposure on #21, Per(-), Mob(-), Bite(-), ice(-), EPT(+3)
4. Impression : Crown fracture without pulpal involvement on #21
5. Treatment plan : Resin build up(incisal & buccal) on #21 with Estelite Sigma Quick(Tokuyama)

III. Conclusion

There are various treatment options for crown fractures of anterior teeth. The restoration of fractured tooth with composite resin is a conservative and economical option. It is important to achieve the proper shade and anatomy in anterior tooth restoration. Fabrication of silicone putty index for palatal wall and using natural layering technique can enhance the quality of class IV composite restoration. With natural layering technique, resin build-up can be performed with 4 layers; palatal enamel wall, opaque dentin shade, body shade, thin labial enamel shade. Estelite Sigma quick(Tokuyama) is a supra-nano filled composite that utilizes 0.2μm spherical fillers. It shows blending effect by high diffusion and refraction of light and has exceptional polishability. A 45-degree long bevel with approximately 2mm width is recommendable to boost the blending effect.

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Management of a complicated crown-root fractured maxillary incisor by orthodontic extrusion

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I. Objective: Orthodontic extrusion as a mean of treating crown-root fracture

Crown-root fracture means fracture involving enamel, dentin, cementum, and/or pulp. In management of crown-root fracture, several factors such as the level of fracture line and the amount of remaining tooth structure should be considered. Treatment options are orthodontic extrusion, surgical extrusion, crown lengthening, and fragment reattachment. Among these, orthodontic extrusion has the advantage of stably positioning the restored tooth and does not involve loss of periodontal support or bony tissue of the surrounding tooth. In this case, a maxillary anterior tooth with complicated crown-root fracture was treated using orthodontic extrusion and crown restoration.

II. Case Presentation: Tooth #11 with palatal subgingival fracture line 3mm below gingival margin

After removing all the fractured fragments of tooth #11, it was assessed that the palatal fracture margin was below the gingival line by 3mm. By orthodontic means, tooth #11 was extruded 3mm in total.

<case >

1. Sex/age: M/15
2. Chief complaint: I fell while riding an electric kickboard and tripped over the sewer
3. Present illness: #11 cold(++), EPT(2/10), per(+), mob 0°
4. Impression: complicated crown-root fracture of tooth #11(FDI system) with vital pulp
5. Treatment plan: root canal treatment and orthodontic extrusion of tooth #11

III. Conclusion

In this case, crown-root fractured #11 was orthodontically extruded. Deciding how much extrusion is needed, biologic width and crown-root ratio was considered. At least 2mm of soft tissue attachment(epithelial attachment, connective tissue attachment) above the alveolar crest is needed, and the margin of the restoration(crown) should be at least 3mm above the crest. In this case the fracture margin was 3mm below the gingival line, and a total of 3mm of tooth extrusion was achieved while the final crown-root ratio being 1:2. After extrusion, stabilization was needed to prevent relapse. According to Lemon et al.(1982) stabilization of 1 month per 1mm of extrusion is needed. Other authors(Simon et al.(1982), Weine and Potashnick(2003)) claim that only 7-8weeks is needed for PDL repair, regardless of the amount of extrusion. In this case, after fibrotomy resin wire splint was applied for 2months. Finally, the tooth #11 was restored by E-max crown shade A2(VITA classic shade guide).

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Esthetic Restorations of Anterior Teeth, the Putty Index Technique

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I. Objective

Traumatic injuries to the anterior teeth can lead to esthetic, functional, and pronunciation problems. These injuries often involve crown fractures with or without pulpal involvement. Such fractures can be restored by direct composite resin, employing techniques such as putty index. This technique offers advantages by enabling precise reproduction of palatal anatomy, thereby saving chair time for a dentist. Additionally, the dentist can use a wax-up cast to explain the treatment plan to the patient. This case report discusses the treatment of patients with esthetic and social problems by using putty index.

II. Case Presentation

<Case I>

1. Sex/age : M/22
2. Chief Complaint (C.C) : I fell down 2 weeks ago, and my teeth on anterior were broken.
3. Present Illness (P.I) : mob (+) on #11
4. Impression : Crown fracture without pulpal involvement
5. Treatment plan : Vitality evaluation and direct resin restoration by using putty index on #11

<Case II>

1. Sex/age : M/11
2. Chief Complaint (C.C) : Resin bonded restoration on my tooth was fallen out.
3. Present Illness (P.I) : per (-) on #21
4. Impression : Crown fracture without pulpal involvement
5. Treatment plan : Direct resin restoration by using putty index on #21

III. Conclusion

Anterior tooth fractures due to traumatic injuries often lead to severe esthetic issues. The putty index technique, being low in technique sensitive, supports a minimally invasive approach and allows for rapid completion of tooth restoration. Moreover, this method facilitates clear communication of treatment plans to patients, ensuring successful outcomes. Therefore, the putty index technique can be considered as a primary treatment option for anterior tooth fractures.

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Space closure using intraoral scanning and injectable composite resin technique

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I. Objective

Diastema can be a one of major esthetic concerns of patients. But because aesthetic standards vary from patient to patient, it is important for a preoperative prediction to communicate between clinician and patient. Conventional method of direct space closure includes impression taking, wax-up, template fabrication process, which is complicated and causes more human errors. Recently, digital impression and Injectable Composite Resin (ICR) technique using transparent silicone index has been spotlighted to overcome those limitations of traditional method.

This case report is about the use of intraoral scanner for design and use of ICR technique for space closure.

II. Case Presentation

1. Sex/Age : M/71
2. Chief Complaint (C.C) : I want to close the gap between my front teeth. I extracted my front tooth 3 months ago.
3. Present Illness (P.I) : #41⁴³ space 2mm , #42 missing tooth
#41,43 per(-) mob(-) pal(-) PPD: WNL
4. Impression : #41,43 chronic periodontitis, #42 missing tooth
5. Treatment plan : Intraoral scan (3Shape, Trios), space closure using transparent silicone index (Any-Flex Clear, MDClus) on #41,43

III. Conclusion

Traditional method of direct space closure has many limitations such as patient's discomfort while taking impression or inconsistency between wax-up model and clinical appearance after treatment. In recent studies the reliability and accuracy of intraoral scanners have been confirmed, demonstrating their suitability as alternatives to conventional impression techniques. Compared with other direct restoration techniques, ICR technique reduces clinical time and has low technique sensitivity as it is easier to perform. Moreover, it has the advantage of being able to duplicate the wax-up model at the treatment site, as it makes communication with the patient more easily for clinicians. Flowable resin composites are preferred due to their proper fluidity. In this case, a more precise model was designed using a intraoral scanners.

ICR approach can be a favorable treatment option for more precise and efficient space closure.

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Restoration of a sub-gingivally crown-root fractured maxillary incisor with orthodontic extrusion: A case report

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I. Objective

The crown-root fractures of anterior teeth are common in cases of dental trauma. The tooth is difficult to properly restore when the fractured margin is subgingival. Preserving the gingival biologic width and crown ferrule are critical for the long-term success of the treatment. Orthodontic extrusion is considered the most conservative approach without surgical intervention. Because it is a good alternative to create a periodontal environment that facilitates the retention of the final restoration by ensuring that the restorative margin does not intrude on the biological width. This case report describes the management of a sub-gingivally fractured maxillary incisor using orthodontic extrusion.

II. Case presentation

1. Sex/Age: Male/18
2. Chief Complaint (C.C): I was riding a bicycle, fell forward, and broke my upper left front tooth
3. Present Illness (P.I) #21: Crown-root fracture (2 mm subgingival fracture line)
Access opened and temporary filled state
per (+), mob (+,slight), pain (-)
4. Impression: Crown-root fracture, previously initiated therapy
5. Treatment plan: Root canal treatment and orthodontic extrusion

III. Conclusion

Crown-root fractures constitute a restorative challenge due to the subgingival position of the fracture margin. This case demonstrates the functional recovery and esthetic reconstruction of damaged tooth by orthodontic extrusion and prosthetic restoration. The orthodontic extrusion not only conserves the biological width but also facilitates tooth reduction for prosthetic restoration by extruding the fracture site above the gingiva, which is expected to contribute to a more esthetic restoration.

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Enhancing the Aesthetic of Discolored Teeth with Direct Laminate Veneers and Vital Bleaching

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I. Objective

Tooth discoloration is one of the esthetic problems. depending on the type and severity of tooth discoloration, the discolored tooth can be treated by tooth bleaching, veneering, or a combination of both bleaching and veneering. vital bleaching can achieve lightening effect using a gel-like chemical solution that is applied directly to the tooth surface. laminate veneers can be considered as a restorations which are expected to correct esthetic deficiencies and discolorations. laminate veneer restorations may be processed in two different ways: direct or indirect. direct laminate veneers have no need to be prepared in the laboratory and are based on the principle of application of a composite material directly to the prepared tooth surface in the dental clinic. In this case, treatment is used for patient with esthetic problems related to discolorations and an old prolapsed restoration by vital bleaching and direct composite veneer.

II. Case Presentation

<Case I>

1. Sex/Age : F/47
2. Chief Complaint (C.C) : I want to brighten my tooth color and replace my old restorations
3. Present Illness (P.I) : per (-) on #12=22
4. Impression : old restoration on #12=22 with discoloration
5. Treatment plan : vital bleaching & removal of old resin material and direct resin veneers on #12=22

III. Conclusion

In this case, treatment is done by vital bleaching and direct composite veneer. vital bleaching is the first step to correct the color of teeth are not done by direct composite veneer (mandible anterior and canine to premolar maxilla). direct composite veneers require minimal removal of tooth structure compared to full veneer crown and have advantage of saving time by single appointment. So, combination of vital bleaching and composite veneer is one of the best treatment choices for discolored teeth. after one-month follow-up, the patient was very satisfied with tooth restoration, which still preserve the natural tooth-like appearance with an acceptable clinical performance. As a conclusion, vital bleaching and direct composite veneer restorations may be a treatment option for patients with the esthetic problems of discolored tooth in cases similar to this reported here.

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Conservative treatment of Peg-lateralis using direct resin veneer

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I. Objective

The peg-shaped anomaly of lateral incisors is a common form of localized microdontia that primarily affects the shape of permanent maxillary lateral incisors, with a higher prevalence in individuals of Mongoloid descent (3.1%). This shape anomaly can lead to significant functional and esthetic challenges for affected patients. Various treatment options are available for managing peg-shaped lateral incisors, including no treatment, direct or indirect resin composite veneers, bonded ceramic crowns or veneers, and in some cases, extraction followed by implant placement. This case report details the restoration of peg-shaped lateral incisors using direct resin veneers.

II. Case Presentation

<Case I>

1. Sex/Age: F/15 Y
2. Chief Complaint (C.C): Referred from Orthodontic department for restoration of #12
3. Present Illness (P.I): #12 Peg lateralis, per (-), mob (-), cold (n)
4. Impression: #12 Peg lateralis
5. Treatment plan: #12 Direct resin veneer

III. Conclusion

In this case, the labial surface of the peg lateral (#12) was at a similar level to the adjacent teeth (#11, 13), making some tooth preparation necessary for veneers or crowns. Alternatively, a direct resin veneer was applied to preserve the sound tooth structure, yielding good short-term results. Direct resin veneers also offer additional benefits, such as lower cost compared to indirect techniques and the convenience of being completed in a single visit.

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Management of Mesially Tilted Mandibular Molars: A Case Report

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I. Objective

Managing mesially tilted mandibular molars presents significant challenges, particularly in endodontic access and prosthetic restoration when the tooth structure is compromised. These cases often require a multidisciplinary approach to address both endodontic and restorative complexities. Treatment options may include tooth recontouring, orthodontic uprighting, or customized prosthetic designs to accommodate the altered tooth position. After evaluating the available options, customized prosthetic restoration was chosen as the most effective solution to restore the tooth's function and aesthetics. This case report details the management of a severely mesially tilted mandibular molar, focusing on endodontic treatment, post and core placement, and final prosthetic restoration, with careful consideration of occlusal forces to ensure long-term stability and function.

II. Case Presentation

<Case I>

1. Sex/Age: Male, 23
2. Chief Complaint (C.C): "My lower tooth hurts when I eat."
3. Present Illness (P.I): #47 Per(-) Pal(-) Bite(-) Mob(0)
4. Impression: Complicated mesially tilted mandibular molar (#47) with significant loss of the mesial crown portion. Undergoing root canal treatment of #47, 3 times at the Local Dental Clinic
5. Treatment plan: Osteoplasty with Flap elevation, Endodontic tx, Fiber Post & Core, Crown restoration of #47

III. Conclusion

In this case, the mandibular second molar (#47) was significantly mesially tilted, complicating access to the mesial canals during endodontic treatment. Extensive loss of the mesial wall necessitated crown lengthening (CLP) to expose sufficient tooth structure for reconstruction. The wall was rebuilt using Z-350 Flow Resin and SE Bond with selective enamel etching. Post and core restoration with Luxa-Post and Luxa-Core provided the necessary retention and stability for the final customized crown, designed to accommodate the tilted insertion pathway and optimize occlusal dynamics. Managing a mesially tilted mandibular molar requires meticulous planning and a multidisciplinary approach, integrating precise endodontic treatment, careful reconstruction of the compromised structure, and a prosthetic design that ensures proper occlusion. This case highlights the effectiveness of modern adhesive and restorative techniques in addressing complex dental anatomies, achieving a high degree of functional and aesthetic success.

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Conservative treatment for complicated crown fracture of permanent incisors

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I. Objective

Complicated crown fracture is a type of dental injury involving damage to the enamel, dentin, and pulp. In the initial stages following pulp exposure due to trauma, inflammation is typically localized within 2 mm of the pulp at the exposure site, allowing for the possibility of treatments aimed at preserving pulp vitality. After vital pulp therapy, various restorative approaches may be considered, depending on the remaining tooth structure. This report presents a case involving the management of a complicated crown fracture through partial pulpotomy and subsequent crown fragment reattachment.

II. Case Presentation

<Case I>

1. Sex/Age : Male/15Y
2. Chief Complaint (C.C) : “I got hit by a ball, and my front tooth broke.”
3. Present Illness (P.I) : #11 horizontal crown fracture with pulp exposure, per(+) mob(-) air(+)
Fractured tooth fragments were preserved in saline solution
4. Impression : Complicated crown fracture on #11
5. Treatment plan : #11 partial pulpotomy and fragment reattachment

III. Conclusion

In cases of complicated crown fractures, maintaining pulp vitality is crucial, even when complete root formation is present, as this approach may reduce the risk of root fractures in the future. In this case, partial pulpotomy was performed using a calcium silicate-based material(Endocem MTA), which successfully maintained the vitality of the pulp and normal apical tissue. Considering the patient's age, fragment reattachment was chosen following partial pulpotomy. Despite the potential risk of reattachment failure, the treatment yielded a favorable aesthetic outcome, demonstrating the effectiveness of this approach in managing complicated crown fractures in young patients.

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Intentional Replantation of C-shaped canal

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I. Objective

In this case report, intentional replantation of C-shaped canal tooth, which has an anatomic limitation, is presented.

II. Case Presentation

<Case>

1. Sex/Age : Male/38

2. Chief Complaint (C.C) :

The second molar on the lower right side has been throbbing with pain for the past three weeks.

- After taking the medication prescribed at the dental hospital emergency room and the local dental clinic on the 28th, the pain has reduced.

- Currently, I feel pain when I'm at rest and press on the gingiva.

- There is a warm sensation, and I also have a headache. Also, when I tilt my head back, I feel pain under the right side of my jaw.

3. Present Illness (P.I) :

#47 : RCT + Gold crown fab. state (5-10YA, L/C), Buccal gingival swelling

Per(+), Mob(+), Pal(+, on buccal side), Bite(+, on cotton roll), PPD : B(6,6,6) L(5,3,6)

PA lesion(+)

4. Impression : Previously treated root canals, symptomatic apical periodontitis on #47

5. Treatment plan : After taking the CBCT, re-RCT or surgery is planned.

III. Conclusion

The procedure of intentional replantation involves multiple surgical steps that must be executed with precision for the best outcome.

-Survival of PDL cells has been noted to be a critical factor influencing successful healing. : Extra-oral time

-Root resections are made, ideally of at least 3 mm, which has been shown to eliminate 98% of apical ramifications and 93% of lateral canals.

-For apical retrofilling, Mineral trioxide aggregate (MTA) has consistently shown outstanding performances in many areas of the endodontic field because of its superior sealing ability and biocompatibility compared with those of other materials.

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Delayed replantation of complete avulsed teeth

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I. Objective

Delayed replantation involves replanting a tooth that has been avulsed and kept outside the mouth for an extended time. This case report describes a case of a 64-year-old male who was struck by a chainsaw 8 hours ago and his teeth fell out. The left maxillary lateral incisor was completely avulsed. The treatment plan was delayed replantation after extra oral endodontic treatment was completed. The patient originally had diastema, so a direct restoration was planned for aesthetic reasons. Although the success of this procedure decreases with time, it can still be a viable option.

II. Case presentation

1. Sex/Age: Male/64
2. Chief Complaint (C.C): I was struck by a chainsaw, which knocked out my right upper teeth and tore my jaw.
3. Present Illness (P.I) : #12 Avulsion (8 hours ago, stored in saline)
 - #42 crown fracture with pulp exposure
 - Laceration wound on upper right inner lip & gingiva (L=1cm, D=0.5cm), chin (L=6cm, D=0.3 cm)
 - Perforation wound on lower left lip (L=2cm, D=3cm)
4. Impression: Avulsion of teeth
5. Treatment plan: Root canal treatment and delayed replantation

III. Conclusion

Delayed replantation of avulsed teeth, though not ideal, remains a viable treatment option, especially in cases where immediate replantation is not possible. Despite potential complications such as ankylosis, root resorption, and prolonged extra-alveolar dry storage time, successful replantation can result in the retention of the tooth in a stable and functional position. This case report explores the indications, techniques, and outcomes of delayed replantation, focusing on its benefits as an interim solution until definitive treatment, such as dental implants, can be considered.

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Intentional Replantation for C-shaped Canal Challenges in Mandibular Second Molars

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I. Objective

This case report aims to describe the treatment of a challenging C-shaped canal in a mandibular second molar using intentional replantation. The report evaluates the clinical effectiveness and long-term prognosis of the procedure, focusing on key factors such as extraoral time and the selection of retro-filling material.

II. Case Presentation

<Case I>

1. Sex/Age: M/20
2. Chief complaint (C.C): My left third molar(#38) is decaying so I decided to have it pulled, but the adjacent tooth(#37) suddenly became very painful, causing significant discomfort and sleep disturbance.
3. Present Illness (P.I): #38: Horizontal impaction, #37: per. (+), mob. (-), pal. (+), bite (+), C-shaped canal, disto-cervical caries
4. Impression: #37
 - Hard Tissue: Caries of dentin
 - Pulpal: Irreversible pulpitis
 - Periapical: Acute apical periodontitis
5. Treatment Plan: Root canal treatment followed by secondary intentional replantation of #37

<Case II>

1. Sex/Age: F/21
2. Chief complaint (C.C): Lower left molar(#37) gums are swollen.
3. Present Illness (P.I): #37: Buccal sinus tract (+), per. (+), mob. (-), pal. (-), bite (-), PA lesion (+), C-shaped canal, distal caries
4. Impression: #37
 - Hard Tissue: Caries of dentin
 - Pulpal: Prior root canal filling
 - Periapical: Chronic apical abscess
5. Treatment plan: Root canal re-treatment followed by consideration of intentional replantation of #37, if needed

III. Conclusion

Intentional replantation (IR) is a procedure often considered when nonsurgical root canal treatments fail or apical microsurgery is not feasible. Teeth with C-shaped canals present significant challenges for these conventional treatments due to their anatomic variations and low accessibility. This case report concludes that IR can be a highly effective treatment option for managing teeth with challenging C-shaped canals.

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Surgical approach of external cervical resorption on Mandibular premolar

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I. Objective

Root resorption is the loss of dental hard tissue (i.e. cementum, dentine and/or enamel) as a result of odontoclastic action. External cervical resorption (ECR) usually manifests in the cervical aspect of teeth; it develops as a result of damage to, and/or deficiency of the periodontal ligament and the subepithelial cementum. Treatment aims include excavation of the resorptive lesion to arrest the resorptive process, restore the resorptive defect and monitor the affected tooth for recurrence. This case reports surgical approach of repairing external root resorption on mandibular premolar.

II. Case Presentation

<Case>

1. Sex/Age : Male/76
2. Chief Complaint (C.C) : #47 RCT referred, no symptom on #34
3. Present Illness (P.I) : #34 w/ per(-), mob(-), bite(-), EPT(+15) ref: #35(+7), PPD(n/s)
4. Impression : #34 external cervical resorption
5. Treatment plan : surgical approach of #34 ECR repair

III. Conclusion

Two systems currently used to classify the extent of lesions are the Heithersay and Patel classifications. The management of ECR largely depends on the location, extent, severity, whether the lesion has perforated the root canal system and the restorability of the tooth. Accurate diagnosis is required for sound clinical decision making, treatment planning and execution of the treatment. Also, continuous long-term follow-up is required

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Management of Immature Permanent Teeth with Pulp Necrosis through Regenerative Endodontic Procedure

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I. Objective

Root canal treatment of immature permanent teeth with pulp necrosis can be a challenge because of thin root dentin walls and open apex, which may lead to risk of root fracture and difficulty of proper obturation. Among possible treatment options, regenerative endodontic procedure(REP) is most preferred for its ability to promote dentin wall thickness and/or root length. This case report describes the management of an immature permanent mandibular 2nd premolar and a traumatized permanent maxillary central incisor through REP.

II. Case Presentation

<Case I>

1. Sex/Age : F/10
2. Chief Complaint (C.C) : Refer from LDC. I have a pimple on my lower left gingiva since 3 weeks ago.
3. Present Illness (P.I) : #35 dens evaginatus fracture state, per(+), mob(-), pal(+), EPT(+), periapical lesion(+), fistula(+)
4. Impression : #35 pulp necrosis with chronic apical abscess
5. Treatment plan : #35 Regenerative endodontic procedure

<Case II>

1. Sex/Age : M/8
2. Chief Complaint (C.C) : I was hit by a car while riding my bike yesterday. My upper teeth are displaced and my upper left tooth feels painful.
3. Present Illness (P.I) : #21 lateral luxation, per(+), mob(+), EPT(+), ice(-), periapical lesion(+)
4. Impression : #21 pulp necrosis with apical periodontitis
5. Treatment plan : #21 Regenerative endodontic procedure

III. Conclusion

In the first case, clinical symptoms were resolved and apical healing was observed. The first case showed increase in root wall thickness and in root length, as well as apical closure. In addition, hard tissue formation between the upper MTA plug and root apex was observed. In the second case, resolution of symptoms and bony healing of the periapical lesion were visible, but there was no definite growth in root length or root wall thickness. Although long-term follow-up is required to assess continued root development, REP can be a successful treatment option for non-vital immature permanent teeth.

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Root canal treatment of a mandibular first molar with C-Shaped root canal configuration

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I. Objective

One of the significant anatomical variations, the C-shaped canal, primarily occurs in mandibular second molars but can also rarely be found in mandibular first molars. Instead of having separate orifices, the C-shaped canal presents a connected form. Due to its complex and irregular shape, it is more challenging to remove infected debris or tissue compared to the typical root canal configuration, making filling difficult as well. Therefore, greater attention is required to ensure the success of root canal treatment. This case report describes the root canal treatment of a C-shaped canal in a mandibular first molar.

II. Case presentation

1. Sex/Age : Female/21
2. Chief Complaint (C.C) : Referred from the orthodontic department due to a periapical lesion and gingival swelling
3. Present Illness (P.I) : #46 resin filled state (distal)
 - mild swelling on buccal gingiva
 - periapical radiolucency
 - air(-) per(-) mob(+) EPT(+) pain(-)
 - PD = distobuccal full depth, 6mm(B), 4mm(L)
4. Impression : Chronic apical abscess
5. Treatment plan : Root canal treatment on #46

III. Conclusion

Treatment of C-shaped canals requires careful attention due to their anatomical complexity. It is essential to predict the canal morphology using preoperative radiographs. During the canal shaping and cleaning stages, efforts such as ultrasonic irrigation should be made to remove as much infected tissue as possible. When filling the canal, techniques that ensure maximum sealing should be considered. Follow-up is necessary to confirm the healing of the lesion.

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Non-surgical Root Canal Treatment of Maxillary Central Incisor in Patients with Dentinogenesis Imperfecta

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I. Objective

Dentinogenesis Imperfecta(DI) is a genetic diseases with a hereditary development disturbance in dentin formation, and it is classified into three types(Type I, II, and III) based on clinical, radiographic, and genetic characteristics. This case report presents a clinical case to highlight the challenges associated with endodontic treatment in patients with DI(type II), particularly due to the condition's impact on dentin microhardness and canal calcification. Since canal calcification is commonly observed in DI patients, special caution is required during treatment. In this case, the objective is to discuss the considerations and techniques used to overcome these challenges to achieve successful endodontic outcomes.

II. Case Presentation

<Case I>

1. Sex/Age : M/38
2. Chief Complaint (C.C) : Referred from Prosthodontics for #21 evaluation
3. Present Illness (P.I) : #21 per(-) mob(-) cold(-) EPT(-) periapical radiolucency
4. Impression : Dentinogenesis Imperfecta(type II), #21 pulp necrosis with asymptomatic apical periodontitis
5. Treatment plan : #21 RCT. If needed, apicoectomy

III. Conclusion

In conclusion, the successful non-surgical root canal treatment of a maxillary central incisor in a patient with Dentinogenesis Imperfecta(DI) demonstrates that despite the challenges posed by calcified canals and weakened dentin, careful planning and the use of specialized techniques such as straight-line access and thorough chemical irrigation can lead to positive treatment outcomes. This case underscores the importance of early diagnosis and tailored endodontic approaches in managing patients with DI, while also emphasizing the need for further research into optimal treatment protocols for this condition.

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Poorly differentiated carcinoma of the anterior part of the mandible misdiagnosed as osteomyelitis

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I. Objective

Radiolucent lesions with ill-defined borders in the mandible include osteomyelitis, osteonecrosis and various malignant tumors. Such lesions share several common characteristics that make them difficult to differentiate. Initially, our radiolucent lesion of mandible was clinically diagnosed as osteomyelitis. Endodontic therapy was administered to teeth #32-42 as the treatment plan of the Oral Maxillofacial Surgery(OMFS) Department. However, multiple lung nodules were identified on the chest PA, and an incisional biopsy was performed prior to surgery. As a result, this lesion was diagnosed as poorly differentiated carcinoma. In this report, we identified characteristic factors of our case to differentiate malignancy from other lesions through a comprehensive clinico-radiologic evaluation.

II. Case Presentation

<Case I>

1. Sex/Age : Female/50y
2. Chief Complaint (C.C) : My jawbone around the teeth is swollen, and the teeth are loose. There is no discomfort.
3. Present Illness (P.I) :
#32,31,41,42 per(-)/cold(-)/ept(-)/mob3/pal(-), #33,43 per(-)/cold(+)/ept(4/10)/mob0/pal(-)
Large, bluish swelling was identified in the buccal area of anterior mandible which clinically mimicking an large cystic lesion(2cmx2cm), pain(-)/pal(-)/numbness(-)/redness(+)/tenderness(-)
4. Impression : #32,31,41,42 pulp necrosis with asymptomatic apical periodontitis and root resorption
r/o Osteomyelitis
5. Treatment plan : #31,32,41,42 preoperative root canal treatment before surgery of the OMFS department

III. Conclusion

In this case, negative pulp vitality of the teeth was identified, suggesting the consideration of pulp necrosis. The presence of ill-defined osteolytic areas and cortical bone destruction could be interpreted as osteomyelitis. However, the affected teeth showed multiple root resorptions without severe caries or restorations, suggesting the possibility of the neoplasm rather than odontogenic origin. Also, this lesion showed rapid expansion with abrupt loss of buccal cortical bone, indicating of aggressive growth pattern more than benign or inflammatory lesion. It is widely recognized that malignant tumors usually showed “floating tooth appearance”, which is the result of rapid bone destruction without root resorption. However, not only multiple root resorptions were present, but also exhibited a spike-type morphology without the floating appearance. This spiking root resorption is known to the specific finding associated with osteosarcoma; however, in our case, characteristic periosteal response was not observed. According to our literature review, spiking root resorption can be observed not only in osteosarcoma but also in other benign and malignant tumors, including poorly differentiated carcinoma. We suggest that our case is consistent with the findings of this literature review. If this root resorption is identified with other aggressive growth pattern, an incisional biopsy should be performed to exclude the possibility of malignancy.

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Treatment of Pulpal Involved External Root Resorption with MTA

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I. Objective

External root resorption can be occurred by trauma, orthodontic treatment, infection, stimuli from a necrotic dental pulp and other causes. In the present case, external root resorption with pulpal involvement of the palatal root became clear after the application of intracanal medicament with calcium hydroxide (Ca(OH)₂), and cone-beam computed tomography (CBCT) taking. Treatment options can be various for such cases. This case report introduces one of the ways to manage pulpal involved external root resorption with non-surgical methods using mineral trioxide aggregate (MTA).

II. Case Presentation

<Case>

1. Sex/Age : M/57
2. Chief Complaint (C.C) : My upper right molars hurt.
3. Present Illness (P.I) : #17 per(+), bite(+), cold(-), ept(-)
4. Impression : #17 pulp necrosis w/ symptomatic apical periodontitis w/ secondary caries R/O) root resorption
5. Treatment plan : #17 conventional root canal treatment and crown

III. Conclusion

Treatment of external root resorption with pulpal involvement can be approached through both surgical and non-surgical methods. Initially, a surgical intervention was considered; however, a CBCT scan revealed that the palatal bone adjacent to the resorption site remained intact. Consequently, a non-surgical approach was selected. Various techniques were considered, and in the present case, the perforation was repaired using ProRoot MTA[®] after sealing the apical part with gutta-percha and AH plus[®] sealer on the same day. Typically, perforations should be addressed immediately upon identification; however, in this instance, repair coincided with root canal obturation. At the nine months follow-up, radiographic examination demonstrated well-healed periapical tissues with intact periodontal ligament, and the patient exhibited no symptoms. Based on this case, it may be cautiously concluded that external root resorption with pulpal involvement can be effectively treated using a non-surgical approach with MTA on the same day as obturation.

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Evaluation of the Antibacterial activity of calcium silicate sealers

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I. Objective

For successful root canal treatment, it is crucial to eliminate infected microorganisms from the root canal system and prevent subsequent microbial invasion. Consequently, utilizing an endodontic sealer with antibacterial properties can help mitigate the growth of any residual microorganisms. The calcium silicate sealer has demonstrated efficacy in preventing bacterial re-contamination of the root canal system and minimizing micro-leakage. Therefore, this study aims to evaluate the effectiveness of the antibacterial activity of five different calcium silicate sealers compared to the AH Plus sealer

II. Materials & Methods

The antibacterial activity of the sealer was assessed against *Enterococcus faecalis* through a study that compared AH Plus (Dentsply DeTrey, Konstanz, Germany), an epoxy resin-based sealer, with five different calcium silicate sealers (Endoseal MTA; Maruchi, Wonju, South Korea, Ceraseal; META Biomed, Cheongju, South Korea, One-fil; MediClus, Cheongju, South Korea, DIA-Root; Dia Dent, Cheongju, South Korea, Well-Root; Vericom, Chuncheon, Korea). To evaluate bacterial activity, direct contact test (DCT), and modified direct contact test (DCT) were conducted. In the DCT, antibacterial activity was assessed on the 1 day and 7 days following the application of the microbial suspension to the surface of the sealer specimens in each experimental group. In the modified DCT, antibacterial activity was measured at 20 minutes, 1 day, and 7 days. Statistical analysis was performed using SPSS Statistics 21, with a significance level set at $p < 0.05$.

III. Results

In the DCT, AH Plus exhibited the lowest antibacterial activity across all time periods, while One-fil showed significantly higher antibacterial activity compared to AH Plus, which served as the control group. In the modified DCT, DIA-Root displayed the highest antibacterial activity on 0 day, and both One-fil and DIA-Root exhibited substantial antibacterial activity on 1 day and 7 days.

IV. Conclusion

All six root canal sealers tested in this study demonstrated varying degrees of antibacterial activity against *E. faecalis*. One-fil exhibited the highest level of antibacterial activity among the sealers evaluated.

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Dentinal tubule penetration of heat-resistant premixed hydraulic calcium silicate-based root canal sealer

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I. Objective

To compare the dentinal tubule penetration of heat resistant premixed hydraulic calcium silicate-based root canal sealer with conventional calcium silicate-based sealers, using warm compaction technique and sealer obturation technique on two different distance from apex.

II. Materials and Methods

30 single-rooted premolars were randomly divided into 6 experimental groups (n=5). Teeth were prepared with Protaper Gold and flushed out with 5.25% NaOCl solution. 0.1% of Rhodamine B™ was added pre-mixed hydraulic calcium silicate based sealer. Sealer types are Endosequence BC, TotalFill BC, and Endosequence BC HiFlow. Filling methods are sealer obturation technique and warm vertical compaction technique. Teeth were sliced horizontal to their long axis using slow speed diamond disks under continuous water cooling 3 and 5 mm from apex. The two-way ANOVA test was used to compare between the type of sealers, the filling techniques and the distance from apex.

III. Results

In this study, Sealer type, Filling method and distance from the apex($p<0.00$) showed all significantly differences in the penetration depth. The dentin penetration of the sealer type was not significantly influenced by filling technique. The obturation method which canal was filled using Endosequence BC HiFlow with Warm vertical compaction method was showed the highest penetration depth. All warm vertical compaction technique showed superior performance compared to sealer obturation technique. The results showed excellence in the order of Endosequence BC HiFlow, TotalFill BC, and Endosequence BC in both filling technique.

IV. Conclusion

Endosequence BC HiFlow showed the deepest dentin penetration in both filling technique. It was supposed Endosequence BC HiFlow has superior flowability and viscoelasticity compared to other conventional Calcium silicate root canal sealers because of the fine particles..

Using Warm vertical compaction, the heat and pressure applied during root canal obturation could have led to deeper penetration into the dentinal tubules. In this study, Endosequence BC HiFlow sealer could be used for deep dentinal tubule penetration in both filling technique because of their heat resistance and fine particles.

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The Effect of Social Changes Caused by COVID-19 and Implants on Cracked Teeth

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I. Objective

This study aimed to analyze the effect of the social changes caused by COVID-19 and increasing implant placement in South Korea on the occurrence and characteristics of cracked teeth.

II. Materials & Methods

Data on patients who underwent posterior crowns at Department of Conservative Dentistry, Seoul St. Mary's Dental Hospital from 2014 to 2022 were extracted through Clinical Data Warehouse (CDW). the incidence, characteristics and prognosis including risk factors of cracked teeth were compared between three periods: before (2014-2015), after implant insurance (2016-2019) and COVID-19 period (2020-2022). insurance (2016-2019), and after Covid 19 (2020-2022). The chi-squared test was used to compare incidence of cracked teeth between before and after implant insurance and Bonferroni method was used for correcting multi-test, while chi-squared test or Fisher's exact test was used to compare association between various risk factors. A P value <0.001 was used as the threshold for statistical significance.

III. Results

Similar to the rapid increase in the number of implant placements after implant insurance, an increase in cracked teeth was observed. However, unlike before, the pain at the time of first visit decreased, and root canal treatment in relation of irreversible pulpitis has decreased. In the analysis of the correlation between prognosis and risk factors, in the observation group after COVID-19, if there was biting pain before treatment, it lasted even after 3 months ($p<0.001$).

IV. Conclusion

The presence of surrounding implants appears to affect the occurrence of cracked teeth. During the COVID-19 period, there were early symptoms or residual symptoms after treatment, possibly related to a lowered pain threshold due to COVID-19. Long-term observation will be necessary to determine the relationship between various factors and prognosis.

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Challenges in the Diagnosis and Treatment of a Maxillary Central Incisor with Multiple Root Fractures

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I. Objective

Horizontal root fracture (HRF) is defined as the fracture line that extends transversely or obliquely across the long axis of the root. HRF in traumatized teeth occurs predominantly in the anterior teeth of young adults due to dental injuries. HRF is diagnosed based on a horizontal fracture line in periapical radiographs. Patients with HRF often experience symptoms such as tooth mobility, displacement, and sensitivity to touch. However, periapical radiographs may not detect a horizontal fracture line during emergency treatment.

In this case, we will discuss diagnosing and treating a central incisor with a middle-root fracture combined with a crown-root fracture. Multiple fractures in one tooth are relatively rare, making it challenging to treat the tooth effectively.

II. Case Presentation

<Case I>

1. Sex/Age : F/25
2. Chief Complaint (C.C) : I fell down the stairs and hit my front teeth. My upper front two teeth really hurt.
3. Present Illness (P.I) : #21 per(+) mob(+) cold(-) EPT(-) Complicated Crown-root fracture (Diagnosed at first visit)
Middle root fracture (Diagnosed in 1 Month after the trauma)
4. Impression : #21, multiple fractures at middle-root and complicated crown-root fracture
5. Treatment plan : #21 coronal fragment re-attachment, resin-wire splint and RCT

III. Conclusion

This case presents a traumatized central incisor with two oblique fracture lines in the coronal and middle thirds of the root. Initially, the middle root fracture was not detected at the first visit, and only the crown-root fracture was diagnosed, and only reattachment was performed. A coronal tooth structure was displaced when the middle root fracture was diagnosed based on the periapical radiograph and visual examination. This case highlights the importance of close follow-up and the potential for multiple fracture lines in dental trauma. It also demonstrates that teeth with complex fractures can be preserved with appropriate treatment and follow-up. The successful management of this case over six months underscores the value of conservative approaches in dental trauma, even in seemingly severe cases that might otherwise be considered for extraction.

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