Development of diffusion pathway in the initial enamel caries lesion by acid buffered solution

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Abstracts

I. Objective: Carious lesions occur within the dentition in a very characteristic pattern. Initial caries of the enamel surface at stages preceding subsurface demineralization resulted in partial dissolution of the outer microsurface. These experiment suggested that there may be a very early stage where the enamel surface is opened up by acid attack. For this reason we produced enamel artificial caries lesion, to examine in the SEM the ultrastructural surface change and crystal level at eary initial caries lesion in enamel..

II. Materials & Methods: In this study, enamel specimens were demineralized artificially by lactic acid buffered solution. Images were taken by a polarizing microscope and SEM in periods of 1,2,4,8,12,24,48 hours. Specimens, being divided into 4 groups, were immersed in lactic acid buffered remineralization solutions with different pH, lactic acid for 5,10days. Surface changes were observed by SEM and measured by EMS.

III. Results: The initial caries on the enamel surface occurs in the perikymata and in the enamel rod around it. The diffusion pathway in the enamel rod occurred by increasing the intercrystalline space between the enamel rod and interred enamel. Hydroxyapatite crystals were dissolved through the diffusion pathway as decalcification proceeded. They combined with each other and formed a cluster or new crystal. While the diffusion pathway was maintained in the low pH experimental groups due to decalcification and remineralization, the diffusion pathway was lower in the high pH experimental groups due to remineralization.

IV. Conclusion: The diffusion pathway in the initial enamel caries occurred by increasing the intercrystalline space between the enamel rod and interred enamel. Hydroxyapatite crystals were dissolved through the diffusion pathway combined with each other and formed a cluster or new crystal. The diffusion pathway was more increased in the low pH groups than in the high pH groups because of simultaneously being occurred decalcification and remineralization

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Caries protective effect of three desensitizing agents on root dentin

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Abstracts

I. Objective:

This study aimed to evaluate the caries-protective effect of three desensitizing agents and to determine the prolonged efficacy of the materials.

II. Materials & Methods:

Thirty human premolars were sectioned into quarters, and each quarter root surface was coated with one of commercial desensitizing agents (Gp 1; no treatment, Gp 2; Varnish XT, Gp 3; Seal & protect, Gp 4; Clearfil Protect Bond). Each 10 specimens were stored in water for 1 day, 30 days, 60 days, respectively, and subjected to pH cycling. Scanning electron microscopy was used to determine the demineralization bands created in the subsurface layer. Electron probe microanalysis determined the weight percentages of Ca loss in the demineralized layer. The fluoride release from the desensitizer-coated root dentin was measured in each group.

III. Results:

Without treatment, in the demineralized layer, 69.94 ± 10.04 % of Ca loss occurred from pH cycling, and the average lesion width was 13.97 ± 4.44 μm. No demineralization occurred in other groups. All three desensitizers remained intact until 60 days. Fluoride release from glass ionomer varnish was significantly higher than other adhesive-based agents ($p<0.05$).

IV. Conclusion:

Root surface coated with three desensitizing agents were resistant to acid challenge. Caries-protective effect of the materials seemed to be from physical barrier formation rather than fluoride releasing capacity.

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Effect of water on phase separation phenomenon of two-step total etching system

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Abstracts

I. Objective:

The objective of this study was to investigate on phase change of two step total etching system by water.

II. Materials & Methods:

Three commercial two-step total etching adhesives-OptiBond Solo Plus (OPB), Single Bond Plus(SB) and Excite(EX) were used. Three adhesives were mixed with 1, 2, 3, 4 and 5 $\mu\ell$ distilled water(d/w) respectively. Control group was not mixed with d/w. After mixing(10s) and air-drying(30s), these samples were observed under light microscope(LM) for examination of phase change. 10 consecutive drops of adhesives were deposited on slide glass. Images were captured immediately after deposition with Standard goniometer(ramé-hartinstrumentco.,Netcong,USA). The DROPimage Advanced software(ramé-hartinstrumentco.,Netcong,USA) provided the value of contact angle. The amount of volatile part in adhesives was determined by a precision balance(OHAUS Co., 19A Chapin Road, Pine Brook, NJ 07058 USA).

III. Results:.

In LM examination, OPB and Ex were observed with phase changes, but SB was not. The contact angles of OPB and Ex were higher than SB. There were no significant differences among these three experimental groups. Due to hydrophobicity of OPB and EX, they showed the phase change in less wet condition.

IV. Conclusion:

OptiBond Solo Plus and Excite are expected to be more sensitive to over-wet condition in wet bonding technique.

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The effect of dentin powder and light-cure time on the degree of conversion of a self-etching adhesive

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Abstracts

I. Objective: Self-etching adhesives are widely used in modern adhesive dentistry due to their convenience. However, initial degree of conversion (DC) is low due to reaction between acidic self-etching monomers and basic amine activators. This study investigated the hypothesis that the DC of self-etching adhesives be increased in vivo because of neutralization of self-etching adhesives by dentin. The objective of this study was to evaluate the effect of the amount of dentin powder, light-curing time, and agitation time on the polymerization of a self-etching adhesive.

II. Materials & Methods: Dentin powder was obtained by grinding extracted teeth and used in dry powder form. According to each variable, such as the amount of dentin powder, light-curing time, or agitation time of the adhesive with dentin powder, the DC of Adper Prompt (3M ESPE, USA) was measured using FT-IR spectrophotometer, immediately after curing, and at 48 hours after curing.

III. Results: The amount of dentin powder affected the initial degree of conversion ($p < 0.05$) and have a positive correlation ($r = 0.840$, $p = 0.001$), but there was no significant difference in the degree of conversion at 48h after curing. Light-curing time affected the degree of conversion measured both immediately and at 48h after curing ($p < 0.05$) and have positive correlations with both of them (immediate, $r = 0.806$, $p = 0.002$; at 48h, $r = 0.779$, $p = 0.003$). The agitation time of the adhesive with dentin powder did not affected to the degree of conversion of the self-etching adhesive.

IV. Conclusion: When a self-etching adhesive is used for dentin bonding, it would be better to light-cure for a longer time than the recommendation by manufacturer for obtaining better polymerization.

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Effect of various solutions on discoloration of nanocomposite resins

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Abstracts

I. Objective: The purpose of this study was to test the effect of staining solutions on the discoloration of dental nanocomposite resins that have various shades.

II. Materials & Methods: Three different nanocomposite resins (Ceram X, Grandio, Z350) were chosen, and filled in a metal ring mold (height: 2 mm, inner diameter: 8 mm). The top and bottom surfaces were covered with a thin glass slide, light polymerized for 40 seconds under 1000 mW/cm^2 condition, and then aged for 24 hours at 37 degree in a chamber. After 24 hours, the initial color of specimens was measured using a spectrophotometer under the %R (Reflectance) mode. After that, specimens were immersed in 4 different test solutions (distilled water (DW), coffee (CF), 50% ethanol (50ET), and green tea-brewed (GT)) 7 hours/day for 3 weeks. After that, the second %R measurement was performed. Based on the CIE$L^*a^*b^*$ color coordinate values from the %R, color difference (ΔE^*) was obtained. The calculated ΔE^* values were statistically analyzed by a 2-way ANOVA at a significance level of 0.05.

III. Results: After being immersed for 3 weeks, specimens immersed in DW, 50ET, and GT showed a slightly increased the L^* value regardless of product and shade. CF decreased the L^* value and increased the b^* value in specimens. DW, 50ET, and GT induced perceivable (noticeable) color change. On the other hand, CF induced marked (appreciable) color change (ΔE^*: 3.1~5.6) in most specimens.

IV. Conclusion: Coffee induced an unacceptable range of color change in dental nanocomposite resins. To prevent or reduce such discoloration, a gentle brushing after taking coffee is needed to minimize the adsorption of brown colorant on the surface.

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In vitro measurement of the mechanical properties of resin infiltrant : Penetration pattern , Viscosity, Surface roughness, Microhardness

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Abstracts

I.Objective: White spot, considered to be early caries lesion, has been shown to be associated with increased enamel porosity. Instead of removing porous dental hard tissue at a later stage of disease progression, "filling" microspaces of the lesions at a much earlier stage of development has been considered.

In this study, we evaluated the viscosity of resin infiltrant and several adhesives (Scotchbond Multi-Purpose , Clearfil SE bond, All-bond 2, All-bond 3). We observed the penetration of the resin infiltrant into natural initial caries by SEM and CLSM, and measured the surface roughness and the microhardness on permanent teeth before and after applicating resin infiltrant into initial enamel caries.

II.Materials & Methods: The viscosity measurements of resin infiltrant and adhesives were performed using a cone-plate viscometer. And extracted human teeth showing white and brown spot lesions with applicating resin infiltrant(with or without fluorescence dye) were cut across the lesion perpendicular to the surface and these were observed by SEM and CLSM. Twenty extracted teeth showing initial lesions were collected and evaluated the surface roughness of initial caries with and without applicating resin infiltrant. Ten extracted teeth showing initial lesions were collected, cut across the lesions perpendicular to the surface and evaluated the microhardness of initial caries before and after applicating resin infiltrant.

III.Results: The viscosity (cP) was observed for resin infiltrant(623.34), Clearfil SE bond(713.92), and All-bond 3(1800.12). An application procedure of resin infiltrant increased the surface roughness and the microhardness insignificantly (p>0.05), when compared to non-applicated specimens.

IV.Conclusion: Resin infiltrant which is easy to penetrate into initial caries lesion had low viscosity. Resin infiltration did not have surface smoothening effect after its application. Therefore, it had to be polished. And resin infiltration made early caries lesions harder, insignificantly. Accordingly, resin infiltration did not seem to have hardening effect.

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The analysis of the heat of polymerization generated from composite resin curing according to the curing mode of lighting unit

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Abstracts

I. Objective: This study was aimed to measure the heat of polymerization, generated when polymerizing resin composite, in various curing modes of halogen and LED light-curing units and to examine the relationship among polymerization, curing depth, curing light intensity, and mode of polymerization.

II. Materials & Methods: In each of rectangular Teflon and ceramic blocks, a class II cavity-like cavity, 5 mm x 5 mm x 4 mm in dimension, was formed. The cavity wall of the ceramic block was treated with hydrofluoric acid, silane, and bonding agent. The proximal side of the cavity was covered with cover glass, and a shield was placed on top of it. Each cavity were filled with flowable composite resin AELITE FLO (Bisco, Schaumburg, IL, USA) and then cured in various curing modes for 20 seconds with the halogen (Optilux 501) and LED(Dr's Light) light-curing units, 1 mm apart from the block. During and after the curing, temperature was measured with an infra-red thermography camera at 10 spots for every 0.2 seconds for each spot for 40 seconds. 5 out of the 10 spots were assigned in the periphery of the cavity, while another 5 were assigned in the center.

III. Results: The temperature was the highest at the spot that was 2 mm deep, followed by the 1 mm-deep spot. Except for the soft-start and pulse soft-start modes, the temperature was the highest from 9 to 11 seconds for the LED unit. The temperature was the highest at the center in the same depth. The temperature was relatively low at the spots where the sample was bonded to the cavity.

IV. Conclusion: There was no difference in temperature rise between halogen and LED curing units if the light intensity was similar. For the same unit, the temperature rose higher in the mode of greater light intensity than in the mode of less light intensity.

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The change in color and opacity by degree of conversion of the light curing resin

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Abstracts

I. Objective: In this study, we measured the change of color and translucency and Vickers hardness of composite resin during polymerization and analyzed correlation among them.

II. Materials & Methods: We used Filtec Z250 and Vitalescence, and shades A1 and A3 were prepared, respectively. Four specimens were fabricated for each shade. The color (CIE L*, a*, b*), opacity, and Vickers hardness of the resins were measured before their polymerization. The measurements were made again for every 10 seconds during 60-second curing. The values were re-measured after additional curing of the resins with UnixXS after 120-second curing and after following 2-week storage at room temperature.

III. Results: Immediately after the curing, the L* values of the resins substantially decreased, and then leveled off. The b* values initially decreased, then soared at the additional polymerization, and then decreased again. The a* values initially increased but then leveled off for the Vitalescence group and increased slightly at the additional curing for the Z250 group. The opacity decreased significantly after 10-second polymerization ($P<0.01$), then showed no great change, then decreased at the additional polymerization, and increased after the 2-week storage. High correlation between Vickers hardness and a* and b* values were found ($R>0.8$).

IV. Conclusion: The results suggest that a* and b* could be used as a measurement for evaluating the degree of conversion and that shade guide should be fabricated in accordance with the color of resin after certain time period or from the same material.

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The evaluation of canal curvature at merging point in Type II mesial canals of mandibular molars

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Abstracts

I. Objective:.

The mesial canals of mandibular molars coalesce to form one major foramen with abrupt angle in 49% of the cases. The file to navigate the abrupt curvature will be forced possibly leading to instrument seperation. The purpose of this study is to evaluate the curvature at merging point in Vertucci's type II mesial canals of mandibular molar using the radius and angle of curvature.

II. Materials & Methods:

Total 115 mandibular molar teeth were selected without making any age and sex discrimination. Following a standard endodontic access in the teeth, their distal roots were removed and 10 or 15 file were introduced into the mesiobuccal and mesiolingual canals of the teeth. We took radiographs of the teeth in the bucco-lingual view and mesio-distal view. Root canals were classified according to Vertucci's classification. In our study, we selected Vertucci's type II and devided two subgroup; IIa and IIb. Specimens of two subgroup were examined the radius and angle of curvature. The results were statistically analyzed using ANOVA test at $p<0.05$ level.

III. Results:.

In Vertucci's type IIa group, radius of mesiolingual canal curvature were significantly smaller than mesiobuccal canal. But, no significant correlation was seen in Vertucci's type IIb group. On the angle of curvature, there were no significant difference in both group..

IV. Conclusion:

In Vertucci's type IIa, ML canals are more abrupt curvature in merging point. Therefore, clinician should be consider abrupt curvature of type II mesial root in mandibular molars to prevent the instrument seperation

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In vivo assessment of MB root anatomy of maxillary permanent molars using CBCT

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Abstracts

I. Objective: The use of CBCT provides noninvasive and 3-dimensional reconstruction imaging for use in endodontic application and morphologic analysis. This study investigated the incidence of second mesiobuccal (MB2) canal in maxillary permanent molars in Korean population using cone-beam computed tomography (CBCT) images and analyzed it by gender and tooth position. The root canal configurations of MB root was also assessed.

II. Materials & Methods: A total of 400 maxillary 1st and 2nd molars from 100 subjects (78 males and 22 females) were evaluated. Three dimensional CBCT images of 400 maxillary molars were analyzed for the detection of MB2 canal and canal configuration was classified according to the Weine's classification. The correlation between gender or tooth position and the incidence of MB2 canal was statistically analyzed

III. Results: For maxillary 1st molars, 27% showed single canal, 70.5% showed two canals (Type II, III, IV), and 2.5% showed three canals. For maxillary 2nd molars, 41.5% showed single canal, 57% showed two canals (Type II, III, IV), and 1.5% showed three canals. There was no significant correlation of gender and tooth position with the incidence of MB2 canal in both 1st molar and 2nd molar ($p < .05$).

IV. Conclusion: Maxillary 1st and 2nd molars in Korean population showed high incidence of MB2 canal and CBCT imaging would be a useful tool for study of root canal anatomy

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Effects of canal enlargement and irrigation needle depth on the cleaning of the apical third of root canal system

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Abstracts

I. Objective: A major challenge in clinical endodontics is the preparation of the apical third region of the root canal system. Because of its anatomy, irrigating needle approach is often difficult to the apical canal, resulting in a reduced effect of the irrigating solutions.

The aim of this study was to test the hypothesis, that the mechanical effectiveness of irrigation in removing smear layer in the apical third of root canal system is dependent on the depth of placement of the irrigation needle into the root canal and the enlargement size of the canal.

II. Materials & Methods: Eighty sound human lower incisors were selected. The teeth were divided into eight groups according to the enlargement size (#25, #30, #35, #40) and the needle penetration depth (3 mm, 9 mm). Each canal was enlarged to working length with Profile .06 Rotary Ni-Ti files. Root canals in all groups were irrigated with 5.25% NaOCl using 30 gauge needle after each instrumentation. Then, each canal received a final irrigation with 3 ml 3%(pH 9) EDTA for 4 min, followed by 5 ml of 5.25% NaOCl at different level (3 mm, 9 mm) from the apex.

Each root was split longitudinally in a mesiodistal direction. Each specimen was prepared for the scanning electron microscope. Photographs of the 3mm area from the working length of each canal with a magnification of x250, x500, x1000, x2500 were taken for the final evaluation.

In a blind manner, three investigators scored the degree of smear layer on the surface of the root canal wall or in the dentinal tubules. After scoring the photographs, the information was recorded and analyzed statistically.

III. Results & Conclusion: From the result of this study, effectiveness of irrigation depends on the aspect of the depth of the needle and the enlargement size of the apical canal. Based on this study model, the removal of smear layer from the apical portion of root canals was effectively accomplished with apical instrumentation to #35/40　06 taper file and 3 mm needle penetration from the working length.

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Analysis of para-chloroaniline after chemical interaction between alexidine and sodium hypochlorite using mass spectrometry

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Abstracts

I. Objective: Recent studies demonstrated that the combination of chlorhexidine (CHX) and sodium hypochlorite (NaOCl) resulted in the formation of a precipitate, para-chloroaniline (PCA) which is a known carcinogen. Alexidine (ALX) is a kind of biguanides like CHX, but has stronger detoxification effect against the bacterial virulence factors such like lipoteichoic acid and lipopolysacchardide compared with CHX. The purpose of this study was to determine whether PCA was formed after chemical interaction between ALX and NaOCl using mass spectrometry.

II. Materials & Methods: For analysis of color change and precipitates, 10 tested solutions were made: 4% NaOCl, 1% ALX, 2.5% CHX, 0.5% PCA, 4% NaOCl with 2.5% CHX, 4% NaOCl with 1% ALX, 4% NaOCl with 0.5% ALX, 4% NaOCl with 0.25% ALX, 4% NaOCl with 0.125% ALX, 4% NaOCl with 0.0625% ALX. Mass spectrometry was performed to detect PCA in the mixture of 1% ALX and 4% NaOCl.

III. Results: Red-brown precipitate (PCA) was formed after mixing NaOCl and CHX, and 128 peak known as PCA was detected in mass spectrometry analysis. The color of the mixed solution of NaOCl and ALX was changed from yellow to white as ALX concentration decreased. In mass spectrometry, the peak of PCA (128) was not detected in mixed solutions of ALX and NaOCl.

IV. Conclusion: These results suggest that the combination of NaOCl and ALX does not result in the formation of PCA. However, further study is needed to evaluate the antimicrobial effect of ALX as a root canal disinfectant.

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Mechanical properties of novel composite using Portland cement for root-end retro-filling material

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Abstracts

I. Objective: MTA fulfills many of the ideal properties of a root-end filling materials. But MTA has poor handling characteristics and initial wash-out problems due to long setting time in clinical using. The aim of this study was to compare the apical sealing ability and mechanical properties of MTA, MTA - AH plus mixture (AMAT) and experimental Portland cement - epoxy resin composite (EPPC) for root-end retro-filling material.

II. Materials & Methods: Forty-nine extracted roots were instrumented and obturated with warm vertical condensation gutta-percha and AH plus root canal sealer. Each root was apically resected (3mm) and the apex was prepared with low speed diamond bur to 3mm depth. Roots were randomly divided into 3 groups of 15 roots each. Groups are MTA, AMTA, EPPC as retrograde filling materials (4 roots were used as control). Following immersion 1% methylene blue dye for 72 hours, the roots were vertically sectioned with slow speed disc and photos were taken for apical microleakage evaluation. All groups were measured for setting time with Vicat apparatus and digital radiographs were taken to evaluate aluminum equivalent thickness using aluminum step wedge. The results from each category were compared between groups using one-way ANOVA and Scheffe's post hoc comparison at the significance level of 95%.

III. Results: AMTA and EPPC showed less microleakage than MTA group. AMTA showed the highest radiopacity than other groups and the novel EPPC had 5 mm aluminum thickness radiopacity. EPPC had the shorter setting time (initial; 62 min, final; 83 min) than other groups while the MTA had the longest setting time.

IV. Conclusion: Under the condition of this study, the novel composite using Portland cement and epoxy resin for root-end retro-filling material may useful with the properties of favorable leakage resistance, radiopacity and short setting time. .

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Endodontic treatment of a maxillary lateral incisor

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Abstracts

I. Introduction: Dens invaginatus is a developmental anomaly resulting from epithelial invagination of the tooth crown prior to calcification. It shows multiple morphological variations of crown and root formation. This leads to caries, pulpal and periodontal involvement with necrosis. Therefore, early diagnosis and prevention are the utmost importance. Maxillary permanent lateral incisors are the most commonly involved teeth. There may also be an associated talon cusp or grooving of the palatal enamel, coincident with the entrance of the invagination.

Because of abnormal anatomical configuration, it is too difficult to treat these teeth. In the present cases, endodontic treatment of a maxillary lateral incisor associated with periapical lesion or Talon cusp will be discussed.

II. Case Presentation:

<Case 1>

1.Sex/ Age: M/14

2.Chief Complaint (C.C): pain on anterior tooth

3.Past Dental History (PDH): N.S.

4.Present Illness (PI): sinus tract (+), palpation (+) on #12

5.Impression: pulp necrosis on #12

6.Tx. Plan: root canal treatment

<Case 2>

1.Sex/ Age: M/21

2.Chief Complaint (C.C): refer from department of orthodontics

3.Past Dental History (PDH): orthodontic treatment

4.Present Illness (PI): EPT (-), cold (-), mob (+)

Root external resorption, talon cusp and dens invaginatus, root canal calcification on #12

5.Impression: pulp necrosis on #12

6.Tx. Plan: root canal treatment

III. Conclusion: The lack of knowledge about possible root canal anatomical configurations can cause a disadvantage for dentists, resulting in an unsuccessful endodontic treatment. A careful clinical and radiographic examination should be conducted to identify dens invaginatus. Non-surgical root canal treatment of the invaginated canal proved successful in promoting the healing of an associated pulp necrosis and sinus tract.

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Conservative treatment for young permanent teeth with necrotic pulps

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Abstracts

I. Introduction: In immature teeth with necrotic pulps, the conventional treatment method was an apexification with calcium hydroxide. Revascularization of necrotic pulps, however, became an alternative conservative treatment option for young permanent teeth with immature roots. When an extremely large communication from the pulp space to the periapical tissues exists, it may be possible for gaining abundant blood supply. The following cases describe a revascularization of immature permanent tooth with a necrotic pulp.

II. Case Presentation:

<Case 1>

1.Sex/age: F/10

2. Chief Complaint (C.C): I have a biting pain

3. Past Dental History (PDH): N.S

4. Present Illness (P.I): Per (+), Pal(+), Mob(-), Sinus tract (+) on #46 buccal gingiva

5. Impression: Dens evaginatus on #45

6. Tx Plan: Root canal treatment on #45

<Cases 2>

1.Sex/age: F/13

2. Chief Complaint (C.C): I have an inflammation at the #14 buccal gingiva

3. Past Dental History (PDH): N.S

4. Present Illness (P.I): Per (+), Pal(+), Mob(-), Sinus tract (+) on #14 buccal gingiva

5. Impression: Dens evaginatus on #14

6. Tx Plan: Root canal treatment on #14

III. Conclusion: Revascularization is in the spotlight as a conservative option in immature permanent tooth with open apex. It has advantages such as consistent root development, reinforcement of root with increased dentin wall thickness, and short treatment period. Revascularization is a promising treatment in young permanent teeth with necrotic pulps and it guarantees the long-term prognosis.

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