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Esthetic and functional restoration of a compromised immature central incisor: a clinical report

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Abstract:
Treatment of severe compromised teeth in the maxillary anterior area still poses great challenge to the clinicians. The present paper aims to report a case of esthetic and functional restoration of a left-maxillary central incisor fractured following a traumatic event on a young patient many years previously. Root canal treatment, functional and esthetic problems are discussed in order to achieve a succeful result.
Key words: *Ceramic restorations, Immature teeth, Biodentine, Incisor Teeth, Dental Esthetics*

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I. Introduction:

Restoring one central incisor remains an aesthetic challenge for the practitioner **(1).** In everyday practice, dentists are confronted to a combination of endodontic, periodontal, and reconstructive problems.

II. Case Presentation:

A 22 -year-old male patient with a compromised maxillary central incisor was referred by the department of endodontics. His left central incisor is horizontally fractured at the mid-third of the discolored crown. The patient reported he was victim of a traumatic incident many years previously **(Fig1).** The patient has a 5mm overbite and asks for an aesthetic free metal solution so an e-max crown is indicated.

The peri-apical radiograph shows incomplete root edification **(Fig2).** The formation of an apical barrier was necessary in order to fill the root canal system without risk of overfilling .Therefore the large canal was filled to the mid-third with biodentine, the rest of the canal was filled with gutta percha **(Fig3).**
After root canal treatment, the tooth responds normally to percussion, palpation and has normal periodontal probings and mobility.

Figure1: intraoral frontal view showing discolorated fractured central incisor

Figure 2: initial periapical radiograph

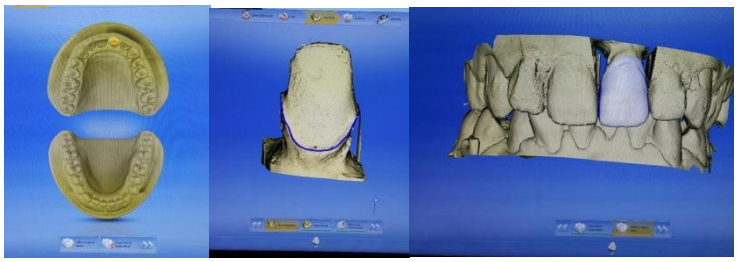
Figure3: Periapical radiograph after root canal treatment

A fully anatomically shaped monolithic lithium disilicate crowns (IPS e.max CAD) is indicated. Finishing line is then carried out supra-gingival to allow bonding which will improve the retention of the restoration **(Fig4).** A temporary crown was made and sealed with eugenol free temporary cement **(Fig5).**

Figure5: intaoral view after tooth preparation

Figure6: patient smile with provisional crown

When designing the E-max CAD/CAM crown symmetry with the right central incisor is achieved. Final result is satisfactory **(Fig 6, 7, 8 and 9).**



Figures 7-8-9: Virtual conception of the crown

Figure 10: Final result

III. Discussion:

The incompletely developed permanent tooth, following a traumatic injury, provides the clinician with diagnostic and clinical challenges. Endodontic treatment poses instrumentation and obturation issues due to the wide canal and thin dentinal walls. The open apex also presentes obturation difficulties, notably in controlling length **(2).**

The American Association of Endodontists defines apexification as 'a method to induce a calcified barrier in a root with an open apex or the continued apical development of an incompletely formed root in teeth with necrotic pulps **(3).** Two types of apexification procedures have been described: calcium hydroxide (multiple visits) apexification and mineral trioxide aggregate (MTA) apical barrier (single visit)apexification **(2).**

The shortcomings of MTA such as difficult handling characteristics **(4)** long setting time **(5, 6),** high cost **(7)** and potential of discoloration led to the development of new materials such as Biodentine (Septodont, France) **(2).**

Biodentine, is a biologically active cement which has dentin-like mechanical properties and can be used as a dentin replacement in the tooth crown and root region. Biodentine can be used for crown and root dentin repair treatment, repair of perforations orresorptions, apexification and root-end fillings. It has great potential to revolutionise the different treatment modalities in paediatric dentistry and endodontics especially after traumatic injuries **(8, 9).**

In this case, due to the fracture, the abutment presents an insufficient height. In addition, after root canal treatment and tooth preparation, extremely thin coronal tooth structure and reduced incisal clearance are noticed.

Restoration with post and core and all-ceramic crown would be an alternative to restore coronal tooth structure loss. However, this option is impossible for two reasons:

1- Restoration with post and core and all-ceramic crown requires ideal overjet and overbite in order to decrease the possibility of fracture of restoration under functional stresses **(10)**.

2- The remaining canal walls are quite thin and therefore there exists a high degree of possibility of root fracture **(2)**.

Thus, a fully anatomically shaped monolithic lithium disilicate crowns (IPS e.max CAD).

The crown retention is insured through bonding and the thikness of the material crown can be reduced compared to a hand-layer-veneered zirconia crown.

The IPS e.max system by Ivoclar Vivadent, offering a variety of products and indications, is widely used for all-ceramic restorations. The five-year cumulative survival was 94.22% (i.e., 94.69% or 90.58% for glass-ceramic crowns or FDPs and 100% or 90.06% for zirconia-based crowns or FDPs **(11)**.

A comparison of failure modes and reliability after fatigue showed CAD/CAM lithium disilicate ceramic in a monolithic/fully anatomical configuration resulted in fatigue-resistant crowns, whereas hand-layer-veneered zirconia crowns revealed a high susceptibility to mouth-motion cyclic loading with early veneer failures **(12).**

Hot-pressing and computer-aided design and computer-aided manufacturing (CAD-CAM) are major techniques for the fabrication of lithium disilicate crowns. Both techniques produced marginal discrepancy values of less than 120 μm, within the clinically acceptable range **(13).**

Because of its median anterior position, a crown on the upper central incisor will be immediately compared with the natural tooth and the slightest differences will be perceived **(9, 10)**. Therefore, design of fully anatomically shaped monolithic lithium disilicate crowns (IPS e.max CAD) is done symmetrically to the right central incisor**.**

As for optical outcome, a try in paste is used to check the final result before bonding .In fact, optical outcome vitro-ceramic crowns is not limited to restoration color , but it also depends on the thikness of the ceramic core, the surface state , the assembly method and materials and the color of underlying substrate **(8).** Once the patient is pleased with the result, the crown is bonded.

The case presented in this report has been followed up over a period of 2 years with no evidence of fracture, debonding, or change in esthetic qualities

IV. Conclusion:

The restoration of a single central incisor is a demanding procedure especially for teeth with extended tissue loss devitalized before complete root canal edification. Saving such compromised teeth may carry risks for failure in the mid and long term; therefore a multidisciplinary team approach to a treatment decision is required.

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