

# AESTHETIC RESTORATION OF FRACTURED ANTERIOR TEETH USING ORIGINAL TOOTH FRAGMENT

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## ABSTRACT

The purpose of this study is to evaluate the success rate for the restoration of fractured anterior teeth, using the original tooth fragment. This treatment procedure was carried out on patients who visited the Dental Clinic, bringing with them the fractured and detached portion of the anterior tooth. Three patients visited the clinic with the fractured incisal half of the upper central incisor. The other three patients visited the clinic with the fractured full crown of the central incisor tooth (two patients) and the lateral incisor tooth. The incisal half of the original tooth fragment was placed in the correct position, and an internal V-shaped notch bevel preparation was performed within the enamel, on both the incisal edge and the remaining portion of the tooth. All the beveled areas were etched with acid and dried with air. After applying the bonding agent, the light cure composite filling material was placed on the etched area all round. The fractured incisal edge was placed on the remaining part of the fractured tooth in the correct position over the composite material carefully and held firmly during the polymerization of the resin. The other three patients visited the clinic with the fractured full crown of the upper central and lateral incisors. In these patients all fractured teeth were treated endodontically in the first stage. In the second stage, a ready made stainless steel post was cemented into the root canal and the fractured original crown was fitted in the correct position using glass ionomer cement (GIC). In the third stage the fracture line was filled with composite as mentioned earlier. The three-year follow-up study showed that this type of treatment was successful in both groups of patients.

## INTRODUCTION

Fracture of the teeth, both in the deciduous dentition and in the permanent dentition is a common clinical problem faced by the dental practitioner. The restoration of fractured, anterior permanent teeth is in demand in routine dental practice. The restoration of the fractured incisor tooth is important both aesthetically and functionally. More than with the other teeth, the upper incisors dominate the physical appearance. When patients come with the fractured upper incisors, they require urgent conservative treatment in order to get the normal aesthetic appearance restored. Fractured anterior teeth can be restored in several ways such as acid-etch technique using composites, jacket crown preparations and post crown preparations. Other than with these types of treatment, the fractured teeth can be restored using the original tooth fragment with bonding materials such as composites and glass ionomer cements (GIC). This method of restoration (using the original tooth fragment) would be more appropriate because it restores the natural appearance (tooth morphology and the incisal edge translucency) more than with other types of treatment. Most patients are not aware that the original fractured tooth fragment could be reattached.

Several studies have reported the use of the acid-etch techniques in order to restore the tooth using composite resins. (Roberts and Moffa 1972, 1973, Bouonocore and Davila 1973, Hinding 1973, Hill and Soetopo 1977, Newman and Helminen 1974 and Oppenheim and Ward 1974). These authors have also described the restoration of fractured incisors using an ultraviolet light polymerized material together with a featheredge technique for bonding the composite resin to the labial and palatal enamel.

Different clinicians and researchers to improve this technique have described different approaches. Jorden et.al (1977) described a chamfer-shoulder type preparation, which provides a finishing line for the restoration. Simonsen ( 1979 ) described a similar technique in which a circumferential bevel preparations was placed around the fracture margins. In both, the chamfer-shoulder and bevel preparations, a little enamel were removed to improve the retention and to create space for the composite filling material at the fracture line. Black, Retief and Lemons (1981) described an in-vitro study to compare the retentive properties of the featheredge , the chamfer-shoulder and bevel procedures. The retentive force of the feather-edge restorations were found significantly lower than that of bevel restorations, whereas retentive forces between chamfer-shoulder and the bevel restorations did not differ significantly. The same study showed that a thin featheredge of composite is also a potential area for breakdown , ledging and resultant accumulation of stains. Simonsen (1982) described a V shaped notch bevel type of preparation to improve the earlier techniques. To keep the entire enamel surface intact , an internal V shaped notch bevel preparation was also done within the enamel, on both the fractured incisal edge and the remaining portion of the tooth. The palatal surfaces were treated with the conventional bevel preparation (approximately 1.5-mm, 45<sup>o</sup> bevel ). Part of the internal dentin in the incisal edge was removed to make room for the calcium hydroxide lining.

No studies have been done in Sri Lanka on these types of restorations. The aim of this study was to evaluate the success rate for the restoration of fractured anterior teeth, using the original tooth fragment and to try new and different approaches in order to improve the retention of these restorations.

## **MATERIALS AND METHODS**

The treatment procedure described was carried out on patients who visited the dental clinic with the fractured portion of the anterior teeth. In this study, three cases were treated at the Faculty of Dental Sciences and the other three cases were treated at a clinic outside the Faculty. The patients were divided into two different groups.

### **Grouping of Patients**

**Group I** Patients who visited the dental clinic with the incisal half of the crown.

1. A 12-year-old girl, with fractured upper right central incisor tooth. The fracture line involved enamel and dentin ( Ellis Class II ) (Ellis, 1948)
2. A 10-year-old boy, with fractured upper left central incisor tooth. The fracture line involved enamel, dentin and the pulp (Ellis Class III ) (Ellis, 1948)
3. A 35 year old female, with fractured upper right central incisor. The fracture line involved enamel , dentine and the pulp ( Ellis Class III ) (Ellis, 1948).

## **Group II Patients who visited the dental clinic with the full crown.**

A 25 year old male, a 12 year old boy and a 49 year old female with a fractured upper lateral incisor tooth, upper left central incisor tooth and upper right lateral incisor tooth respectively. The fracture line in all three patients involved enamel, dentin and the pulp of the cervical margin of the tooth ( Ellis Class VIII ) (Ellis, 1948).

### **MATERIALS USED FOR THIS STUDY**

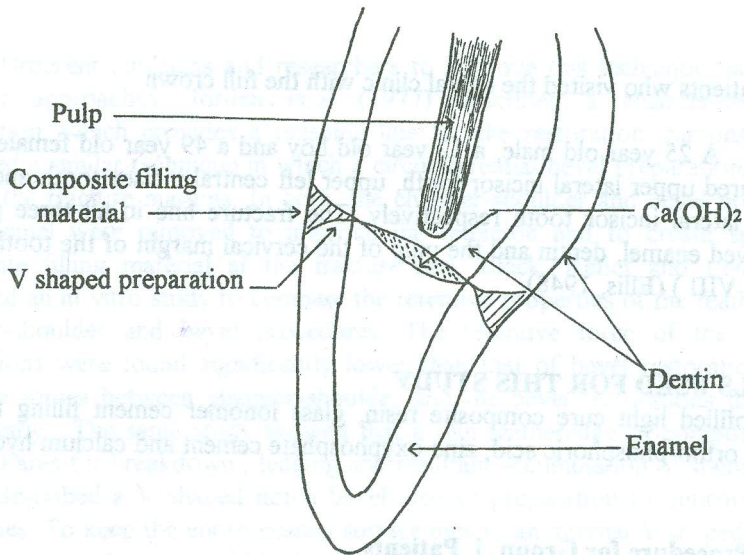
Microfilled light cure composite resin, glass ionomer cement filling material (GIC), 37 % ortho-phosphoric acid, zinc-oxyphosphate cement and calcium hydroxide.

### **Treatment Procedure for Group I Patients**

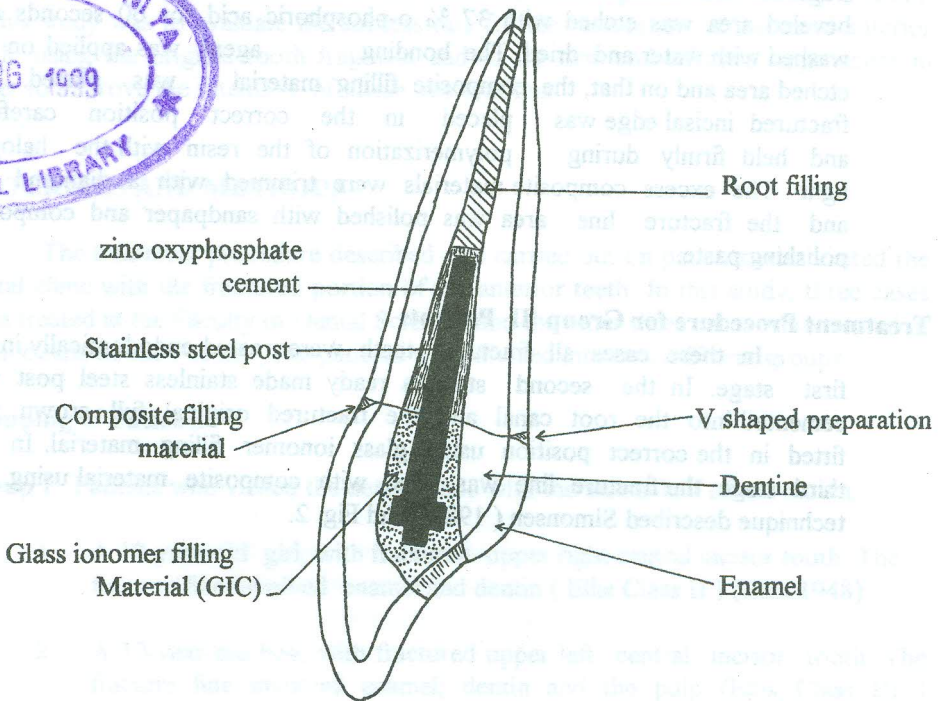
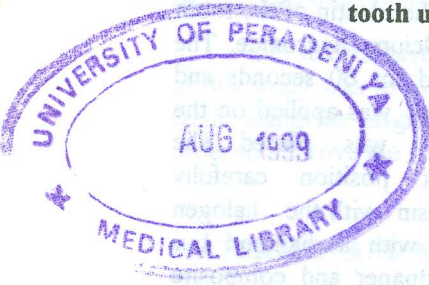
The technique described by Simonsen (1982) was used in this study. The broken tooth fragment was placed in alignment with a remaining tooth and an inverted V shaped notch bevel preparation was done within the enamel both labially and palataly ( Fig.1 ). Part of the dentin of the tooth fragment was removed to make room for the calcium hydroxide. The beveled area was etched with 37 % o-phosphoric acid for 60 seconds and washed with water and dried. The bonding agent was applied on the etched area and on that, the composite filling material was placed. The fractured incisal edge was placed in the correct position carefully and held firmly during polymerization of the resin with the halogen light. The excess composite materials were trimmed with a diamond bur and the fracture line area was polished with sandpaper and composite polishing paste.

### **Treatment Procedure for Group II Patients**

In these cases all fractured teeth were treated endodontically in the first stage. In the second stage a ready made stainless steel post was cemented into the root canal and the fractured original full crown was fitted in the correct position using glass ionomer filling material. In the third stage the fracture line was filled with composite material using the technique described Simonsen ( 1982 ) and Fig. 2.



**Fig. 1. Fractured original incisal half of the crown can be reattached with the remaining part of the fractured tooth using a V shaped bevel preparation and composites.**



**Fig.2. Fractured original full crown can be reattached with the remaining part of the fractured tooth using a metal post and composites**

## RESULTS

### Group I Patient Presentations

**Patient No. 1 :** A 12 year old girl had a fall while playing and she broke the incisal half of the upper right central incisor tooth ( Fig.3 and Fig.4 ). The fractured incisal half of the crown was found and wrapped in a piece of clothe ( Fig. 5 ). The patient visited the dental clinic one-week after the injury. On intra oral examination it was found that the fracture line involved enamel and dentin ( Ellis Class II ). Special investigations such as vitality test and periapical radiographs reveled that there was no evidence of root fracture or pulp exposure. There was a slight colour difference in the fractured fragment due to dry storage for one week. In the clinic the broken portion was stored in isotonic saline in order to bring the normal tooth colour back and the patient was given an appointment to return after three days.

The fractured fragment of the incisal half of the crown and the remaining part of the tooth was polished with pumice. The Simonsen's technique was used to reattach the fractured incisal half of the tooth. The broken tooth fragment was placed in alignment with the remaining tooth and an inverted V shaped notch bevel preparation was made within the enamel labially and palataly. Part of the dentin of the tooth fragment was removed, in order to make room for the calcium hydroxide. The calcium hydroxide ( Dycal ) lining was placed on the exposed dentin area. The beveled area was etched with 37 % o-phosphoric acid for 60 seconds and washed with water and dried with oil free compressed air. The bonding agent was applied on the etched area and above the both area the composite filling material was placed. The fractured incisal half was placed in the correct position carefully and held firmly and excess composite was removed with a smooth instrument at the fracture line. The halogen light equipment was held on the labial surface and the palatal surface for 20 seconds at the fracture line to polymerize the composite resin . The excess composite was trimmed with diamond burs and polished with sandpaper and composite polishing material at the fracture line. The postoperative photograph, immediately after treatment (reattachment), is shown in Fig. 6.

**Patient No. 2 :** A 10-year-old boy had a fall from his bicycle and fractured his upper left central incisor tooth ( Ellis Class III ). The patient visited the dental clinic 4 days after the injury with a complaint of pain. After special investigations it was found that the dental pulp was exposed and infected. The root canal was opened and the necrotic pulp removed. The patient was given antibiotics to control the infection. At the following visit, the root canal treatment was commenced. In the third visit the root canal ( open apex ) was filled with calcium hydroxide. Until this procedure the fractured portion of the tooth was placed in saline. The fractured portion of the tooth was reattached to the remaining part of the fractured tooth using the technique described by Simonsen (1982) as mentioned in patient presentation No.1. In this patient's treatment procedure one modification was done in order to get additional retention. The glass ionomer filling materiel was applied on the exposed dentin area instead of calcium hydroxide lining.

**Patient No. 3:** A 35 year old female had fractured her upper right central incisor tooth ( Ellis Class III ) due to trauma from a metal instrument on her tooth. The patient visited the dental clinic 3 days after the injury. After the special investigations, root canal treatment was done with Gatta Purcha and AH 26 root canal cement. The modified Simonsen's technique was applied in this patient. After one week the coronal part of the Gatta Purcha was removed from the root canal and zinc oxyphosphate lining was placed on Gatta Purcha. The glass ionomer filling material was applied to the coronal part of the pulp chamber and the dentin exposed area of the remaining part of the fractured tooth. The broken tooth portion was reattached to the remaining part of the fractured tooth and excess glass ionomer filling material was removed. The enamel surface of the fracture line was restored with composite filling material using the technique described by Simonsen (1982).

### Group II Patient Presentations

**Patient No. 1 :** A 25 year old male had fractured his upper left incisal half of the central incisor tooth ( Ellis Class II ) and full crown of the upper left lateral incisor tooth ( Ellis Class VIII ) while playing cricket ( Fig. 7 ). The patient visited the dental clinic immediately after the injury with the original full crown of the lateral incisor tooth only. He could not find the incisal half of the central incisor tooth. After the special investigations, the upper left lateral incisor root canal treatment was commenced. In the first stage the root canal of upper left lateral incisor tooth was filled with Gatta Purcha and AH 26 root canal cement. The correct ready-made stainless steel post was selected and the stains on the original full crown was removed ( Fig. 8 ). In the second stage the ready made stainless steel metal post was cemented into the canal ( Fig. 9 ) with zinc oxyphosphate cement. Part of the dentin was removed from the original crown to make room for the metal post. The original full crown was fitted in the correct position using glass ionomer filling material. In the third stage the fractured line was filled with composite using the technique described by Simonsen (1982). The post operative photograph immediately, after the treatment (reattachment) of upper left lateral incisor original crown is shown in Fig. 10. The Upper central incisor would be restored with composite material at a later date.

**Patient No. 2 :** A 12-year-old boy had a fight with his classmate and fractured the full crown of the upper left central incisor tooth ( Ellis Class VIII ). The patient visited the dental clinic six hours after the injury. After the special investigations the original full crown was fitted in the correct position using the technique as mentioned for patient No.1 in-group II procedure.

**Patient No. 3 :** A 49-year-old female had a fall in her bathroom and fractured the full crown of the upper right lateral incisor tooth ( Ellis Class VIII ). The patient visited two days after the injury. After the special investigations the original full crown was fitted in the correct position as mentioned for patient No.1 in-group II procedure.

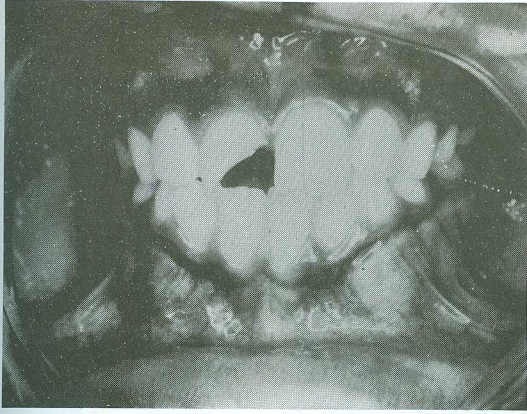


Fig. 3. Fractured upper right central incisor tooth (before treatment) Note: there is no exposure of the pulp (Ellis Class II fracture). The patient is a 12 year old girl.

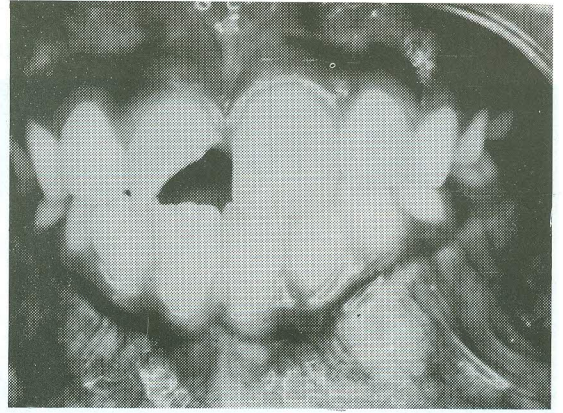


Fig. 4. Upper right central incisor tooth to show the plane of fracture at high magnification. Note: the angle of fracture.



Fig. 5. The incisal half of the fractured original upper right central incisor tooth fragment stored in normal saline and brought to the Dental Clinic by the child's parents.

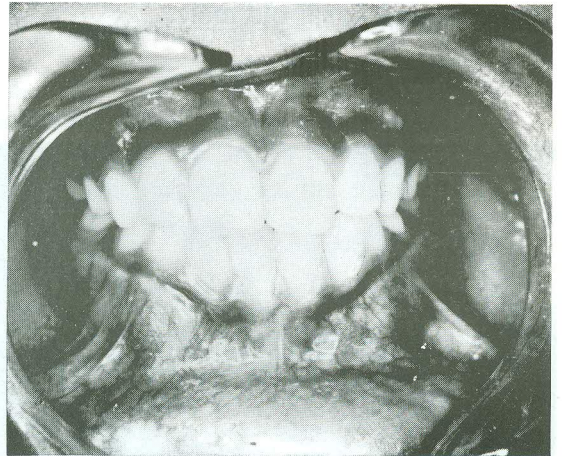


Fig. 6. The post operative photograph immediately after treatment (reattachment) of the fractured original tooth fragment in situ.

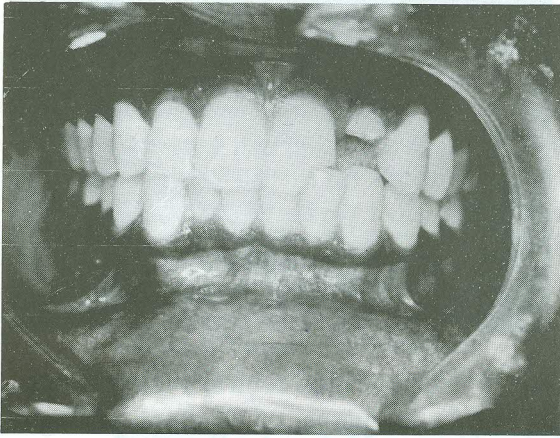


Fig. 7. Fractured full crown of the upper left lateral incisor tooth. Note: The line of fracture is going through the pulp at the level of the cervical margin of the tooth. (Ellis Class VIII fracture). The patient is a 25 year old male.

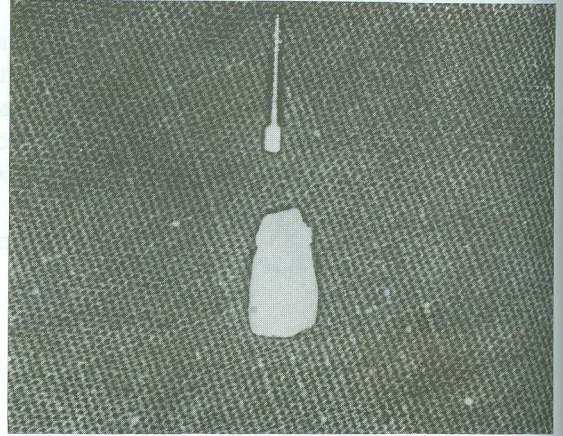


Fig.8. Fractured full crown of the original upper left lateral incisor tooth together with the stainless steel post that would be used for the treatment procedure.

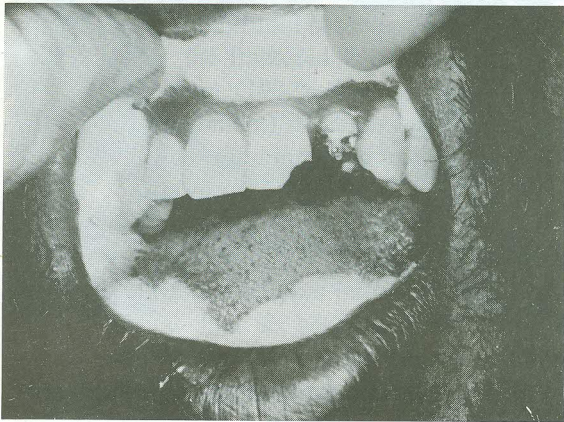


Fig.9. The upper left lateral incisor tooth with the stainless steel metal post in situ cemented with zinc-oxyposphate cement.

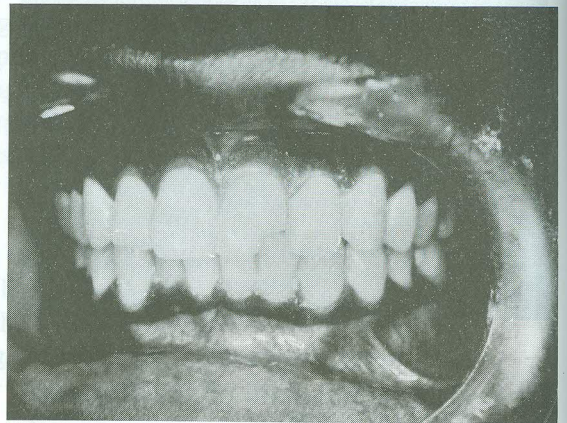


Fig.10. The upper left lateral incisor tooth immediately after fixation of the post and the reattachment of the original full crown in situ. (The fractured upper left central incisor tooth would be treated at a later date).

## DISCUSSION

The restoration of traumatically fractured anterior teeth using the original tooth fragment is a highly conservative method of treatment than the other type of treatment. In the types of restorations undertaken in the present study the success rate is dependent on the following basic factors.

- Need an advanced clinical skills by the practitioner
- Availability of proper restorative materials
- Proper instructions to the patient
- Obtaining patient's corporations and the
- Possibility of regular follow-up.

All six cases in the present study were followed up for a period of three years or more after the restorations were placed. The observations are as follows :

- The aesthetic appearance are normal
- The physical functions are normal
- The retention of the restorations are excellent
- The vitality of the teeth are normal
- There is no discolouration of the tooth crown or filling material and
- There is no periapical pathology or infection identified.

On account of these observations, replacing the fractured anterior teeth with the patient's original tooth fragment, rather than with the construction of a composite resin restoration has the following advantages.

1. The labial surface of the enamel is smooth and shows a glossy appearance. The currently available restorative materials would not match the natural aesthetic characteristics or maintain the colour stability of the natural enamel.
2. The incisal edge translucency of the particular fractured tooth will be preserved.
3. The original morphological appearance of the tooth is restored.
4. The incisal edge will wear in unison with the adjacent teeth. The composite restorations tend to wear faster than enamel.

Black, Retief and Lemons ( 1981) and Simonsen ( 1982 ) described that the bevel preparation gave better results than other type of techniques for restorations. In this study the Simonsen's (1982) technique, was applied in the 12 year old girl (Group I patient No.1) to reattach the fractured incisal half of the original crown. The results showed that the Simonsen's (1982) technique was successful in this patient.

In order to get additional retention for this type of restoration, the Simonsen's (1982) technique was modified in the 10-year old boy patient and the 35-year-old

female patient in-group I. In the 10-year-old patient the exposed dentine area was bonded with glass ionomer filling material to get additional retention. In the 35-year-old patient the coronal part of the root canal was filled and the exposed dentin area was bonded with glass ionomer filling material. The modified technique gives better retention than the Simonsen's ( 1982) technique. In Simonsen's ( 1982) technique, retention was achieved by mechanical bonding between two enamel surfaces ( at fracture line ) with composite filling material, but in the modified technique the retention was achieved in two ways. 1. The mechanical bonding between two enamel surfaces ( at fracture line) with composite filling material. 2. The chemical bonding between two dentin surfaces ( at fracture line ) with glass ionomer filling material. This study showed that the modified technique was successful in group I patient presentations ( patients No. 2 and 3 ).

A new technique was used to reattach the fractured original full crown in all three patients in-group II. In all three patients better retention was achieved in several ways.

The ready-made metal stainless steel post was cemented into the root canal with zinc oxyphosphate cement.

The metal stainless steel post and original tooth crown was chemically bonded with glass ionomer filling material.

The exposed dentin areas ( at fracture line ) was chemically bonded with glass ionomer filling material.

The mechanical bonding between two enamel surfaces ( at fracture line )with composite filling material.

This study showed that the new technique was successful in all the three patients' in-group II. To the best of the authors knowledge there are no studies reported in the literature using this technique.

## CONCLUSIONS

This study showed that all six cases were successful during the three-year follow up period.

In Ellis class II fracture, with involvement of enamel and dentin ,the Simonsen's (1982) technique is the ideal treatment. Dentin primer also can be used to protect the dentin in this technique.

In Ellis class III fracture with involvement of enamel, dentin and pulp, the modified Simonsen's technique gave more retention than Simonsen's technique.

In Ellis Class VIII ( crown fracture at cervical margin ) type of fracture, the new technique gives better results than other type of treatment (eg. jacket crowns or post crowns ) .

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