

Clinical evaluation of bonding techniques in crown fractures

Carlos Garcia-Ballesta* / Leonor Perez-Lajarin** / Olga Cortes-Lillo*** /
Fernando Chiva-Garcia

The technique of bonding fragments when dental fractures occur is a routine procedure. The objective of this investigation is to demonstrate the retention of the fragments bonded using a compound material according to the Simonsen technique. The most noteworthy conclusion is that this type of restoration lasts less than two years when in the mouth. For this reason other therapeutic options with better future expectations should be introduced.

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INTRODUCTION

Dental trauma in permanent incisors is prevalent: it occurs in 24.9% of the North American population aged between six and 50 years¹ and epidemiological studies done in Europe on the school population (six-to 15-years-olds) show a prevalence of incisor lesions ranging from 13.6% (2) to 21%.³ The most frequently-occurring lesions are subluxation (50.6%) and crown fracture 37.5%.⁴

Treatment techniques for non-complicated crown fractures have undergone modifications over the years. Restorations have varied from the time-honored temporary restorations using polycarbonate crowns to the use of composites, either alone or with additional retention systems. In 1964 Chosack⁵ put forward a new reconstruction systems: attaching the coronal fragment to the remaining crown with bonding material. Simonsen^{6,7} described a technique for attaching the coronal fragment by making a notch in the enamel at an angle of 45 degrees thereby increasing retention.

Few works on this topic are to be found in the literature and in none of them is there a high number of cases or an evaluation of efficacy over an extended period of time, even though these techniques have been described for years in pediatric dentistry manuals.⁸

The objective of the present study is to show the results, followed up for more than two years, of treatment done in incisors presenting non-complicated crown fracture. The technique proposed by Simonsen was used and its efficacy is discussed with regard to retention-time and prognosis.

MATERIAL AND METHODS

Eighteen fractures teeth were restored by means of the technique described by Simonsen. A total of 20 fragments were presented but two of them, with comminuted fractures, were found to be unsuitable for restoration. Distribution is described in Table I. Mean age of patients was 8.6 years. Fourteen cases were male and four female. Regarding types of fracture: eight cases were non-complicated with wide exposure of dentin. Cases presenting with/showing other associated lesions (root fracture, luxation) in addition to crown fracture were excluded from the present study, as were cases seeking treatment more than 5 to 6 hours post accident as pulpal therapy could very and the coronal fragment could have become dehydrated. In all cases apices were immature to some degree.

The Simonsen technique⁵ was employed in slightly modified form:

- Immersion of the fragment in saline solution in order to avoid dehydration during the necessary preliminaries of clinical and radiological exploration.
- Anesthesia without vasoconstrictor (mepivacaine) and isolation using a rubber dam.
- Using a fine diamond bur a notch was made, at an angle of 45 degrees and 0.5 to 1 mm. in extension, in both the fragment and in the remaining crown.
- Acid-etching of both tooth and fragment using 37% orthophosphoric acid for 30 seconds; elimination of acid by washing with distilled water for 20 seconds; drying.

* Carlos Garcia-Ballesta, MD, DDS, The Department of Dentistry, University of Murcia, Murcia, Spain.

** Leonor Perez-Lajarin, MD, DDS, The Department of Dentistry, University of Murcia, Murcia, Spain.

*** Olga Cortes-Lillo, DDS, The Department of Dentistry, University of Murcia, Murcia, Spain.

**** Fernando Chiva-Garcia, MD, DDS, The Department of Dentistry, University of Murcia, Murcia, Spain.

Send all correspondence to Dr. Carlos Garcia Ballesta, Hospital Morales Meseguer, Facultad de Odontología, 2da. Planta; Avda. Marques de los Valez s/n; 30008 Murcia, Spain.

Table 1. Distribution according to age, sex and tooth/teeth involved

Case	Age in years	Sex	Teeth
1	7	M	21
2	9	M	21
3	10	F	11-21
4	8	M	11
5	7	M	11
6	8	M	11
7	9	F	21
8	10	M	11
9	7	M	11
10	8	M	11-21
11	8	F	21
12	10	M	11
13	11	M	11
14	8	F	11
15	8	M	12
16	10	M	12
17	7	M	11
18	9	M	11

Mean age: 8.6 years

- Application of dental adhesive, the same one in all cases, basically made up of dimetacrylic resins, cetylamine hydrofluoride, dipentaerythritol monophosphate penta-acrylate and acetone. The adhesive was applied according to the instructions of the manufacturer.
- Union of both pieces using a light-curable composite, in all cases the same composite. This has inorganic filler with a particle size of 0.004 to 0.005mm with an inorganic filler content of 57% in volume and 77% in weight.
- Clinical and radiological monitoring. Monthly evaluation to check retention of fragment and pulpal affectation. Follow-up was monthly over 25 consecutive months.

RESULTS

The following criteria were selected for evaluation of the technique:

Fragment retention. Of the 18 cases, one fragment was retained for one month; in seven cases retention was more than 24 months; mean retention period was 19.5 months. Significant differences in bond strength were found depending on the modality of the fracture (Table 2). Thus, in fractures with little to moderate exposure of dentin, mean retention time was 22.1 months whilst in fractures with wide exposure of dentin retention period was less (mean: 15.1 months).

Pulpal effects. Signs of pulp necrosis were found in one case: a fracture with wide exposure of dentin.

DISCUSSION

A perusal of the relevant literature reveals a disparity in both numbers of cases and in methodology.

The present study of 18 cases contains considerably more cases than any previously work. Previous studies range from one case^{5,8-11} to five cases.¹² Follow-up also varies widely: No follow-up^{5,10-13} two or three weeks^{6,10} three months,⁹ two or three years.¹⁴⁻¹⁷ In the two cases described by Amir¹⁶ two central upper incisors restored with coronal fragments were followed-up for three years, and showed favorable results. In one of the two cases the fragment became detached after 28 months.

Our patients were all within a narrow age-range (8 to 10 years) and had a similar degree of root development (apex open to some degree). In contrast, other published studies presented cases with ages ranging between 10 years with apex closed¹⁵ and much higher ages^{6,7,9,14} up to the case of a 30-year-old among those described by Tenery.¹² A further difference from other studies was that our cases had all suffered non-complicated fractures without concomitant injuries.¹⁴

In the present study, the technique proposed by Simonsen^{6,7} was modified only by the application of a dental adhesive instead of an intermediate resin.

In view of the low number of published reports we decided to compare our results with those of the studies where the conventional technique using composite material was employed. Our mean retention time (19.5 months) was less than that of studies overall where composite material and dental adhesives¹⁸ were used, in which mean retention time was 24 months. However, in cases with little to moderate exposure of dentin retention time was similar (22.5 months) to that found by others.

Due to the characteristics of our sample, pulpal therapy was not necessary; in other reports conventional endodontic treatment was done,¹⁹ and systems of additional retention were also employed.²⁰ These might have had some effect on the adhesion of the fragments.

Our results as regards prognosis of pulp vitality (one out of 19) were similar to those described by others. Thus, Andreasen²¹ found that in non-complicated crown fractures treated with composite material pulpal complications arose in between 1% and 7% of cases.

It is worth pointing out that in our one case where pulpal inflammation was seen there was wide exposure of dentin and pulpal transparency was present and therefore there was a greater possibility of bacterial contamination.

We agree with Andreasen that this technique should only be used in the restoration of non-complicated fractures when the treatment is to be carried out in a single session.²²

Table 2. Fragment retention time in months

Case	Type A	Type B	Months of Retention
1	*		25
2	*		25
3		**	14
4		**	16
5	*		23
6	*		25
7		**	15
8	*		19
9		**	10
10	*		25
11	*		25
12	*		19
13		**	1
14	*		20
15		**	25
16		**	19
17		**	21
18	*		25
TOTAL	10		8

Mean retention: 19.5 months

F. little/moderate dentin exposure (*): 22.1 mo

F. wide dentin exposure (**): 15.1 mo

CONCLUSIONS

We believe that this is the treatment of choice for fractures with little to moderate exposure of dentin, If exposure is wide, retention time is less than when composite materials are used in the restoration. The most probable explanation for this is that with the application of a composite material alone at the level of the fracture line bonding is insufficiently strong. Pulpal prognosis in our sample was similar to that found in studies, where the conventional technique was used.

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