# Crown Fractures in Maxillary Central Incisors; 24 Months Follow-Up and Clinical Outcome in Children

Fracturas Coronarias en Incisivos Centrales Maxilares; Seguimiento de 2 Años y Resultado Clínico en Niños

#### Jaime Andrés Díaz

DIAZ, J. A. Crown fractures in maxillary central incisors; 24 months follow-up and clinical outcome in Children. Int. J. Odontostomat., 2(1):83-94, 2008.

**ABSTRACT**: The purpose of this study is to present the results of a group of 5 patients from 7-12 years old for complicated and uncomplicated crown fractures in their maxillary central incisors. A cross sectional survey of series of 5 clinical cases was desined. Re-attachment of coronal fragments and composite restoration the affected teeth were performed. The patients have been recalled for 24 months follow-up period. All teeth to show adequate clinical and radiographic evolution. In relation to the aesthetic considerations, the outcome has been satisfactory. The treatment requires adequate knowledge about diagnosis, treatment plan and biological, aesthetical, functional and economic aspects. Currently, there is great evidence that pulp, restorative and aesthetic prognosis is good, and has improved in the last years. An immediate first emergency attention, to avoid and/or minimize risk of bacterial invasion through dentinal tubules to the pulp tissue should be performed.

KEY WORDS: crown fractures children, coronal re-attachment, composite -resin build-up.

#### INTRODUCTION

It is known that trauma to the oral region comprises approximately 5% of all injuries. Currently, in accordance to several epidemiological researches dental traumatic injuries are widespread in the population and are a frequent pathology among children and teenagers, especially in population between 7 to 14 years old (Andreasen & Ravn, 1972; Andreasen Andreasen, 1993; Flores et al., 1994; Borssén & Holm, 2000; Marcenes et al., 2000). In paediatric and adolescent populations dental trauma is a serious public health problem, and can affect up to one-third of patients (Borssén & Holm, 2000; Hamilton et al., 1997a). Also, many reports show that crown fractures are the most frequently dental injury in young permanent maxillary incisors (Traebert et al., 2003; Petti & Tarsitani, 1996; Borum & Andreasen, 2001; Tovo et al., 2004; Tapias et al., 2003.). Some articles have reported that 25% of patient population under 18 yearsold, sustained dental injuries in the form of crown fractures in maxillary incisors (Andreasen & Ravn; Petti & Tarsitani). Flores et al. showed in her research in Valparaiso, Chile that uncomplicated and complicated crown fractures in children, the most frequently dental injuries in permanent incisors reach 55%. Resembling results are observed in reports of Borssén & Holm in a cohort of 16-year-old in Sweden . In the future, the prevalence and incidence of traumatic injuries to the teeth will be the most important dental pathology, and overcome caries and dentomaxillary disturbances in children and teen-agers, because their prevalence and the real impact on the children's daily life (Andreasen & Andreasen; Marcenes et al., 1999; Marcenes *et al.*, 2000). Subsequently, anterior crown fractures lead to discomfort and serious psychological, aesthetic, functional and phonetic problems that can affect social relationship (Traebert *et al.*; Marcenes *et al.*, 1999).

Crown fractures in 10 years-old population is considered a real and serious public health problem because the high prevalence (Tapias *et al.*). There are multiples causes of dental injuries to anterior teeth; unspecific falls, sports activities, fights and bicycles

Assistant Professor and Paediatric Dentist, Dental Department, Faculty of Medicine; Universidad de La Frontera & Dental Service, Clinical Regional Hospital, Temuco, Chile.

accidents are the most frequent (Andreasen & Andreasen; Flores *et al.*; Traebert *et al.*; Marcenes *et al.*, 2000; Lombardi *et al.*, 1998; Tapias *et al.*). The reports confirm that dentists and especially paediatric dentists are commonly confronted with managing dental crown fractures on a regular basis (Hamilton *et al.*, 1997b; Murchinson *et al.*, 1999).

The restorative technique treatment selection is not a simple decision and represents a great clinical challenge. Age of the patient, extended of crown fracture, presence of direct pulp compromised, stage of the coronal fragment, stage of dentition development and type of occlusion must be considered by the clinicians to decide the best treatment for each patient (Cavalleri & Zerman, 1995; Olsburgh et al., 2002). Then, restoratives, aesthetics, simple, conservatives and ideally low-costs treatments must be known by the clinicians, to choose the correct alternative at moment of the injury. The dentists have an important and significative role in the prognosis of crown fractures; and depend it of his accurate diagnosis and treatment at pulp and restorative level (Olsburgh et al.).

The following article presents and describes five reports of children with crown fractures in their maxillary permanent incisors, the treatments performed and the results after 24-months follow-up period.

### MATERIAL AND METHOD

The following cases reports corresponded to a group of five children between 7 to 12 year old (means age 9.0 years-old), four males and one female, whom were attended because of crown fractures in their maxillary incisors at paedodontic dental service of Regional Clinical Hospital, Temuco, Chile, between June 2005 and June 2007. The material included clinical records, radiographic examination and photographies of eight maxillary incisors with crown fractures.

Clinical and radiographic records of each patient included: sex, age of the patients at the time of injury, cause of the dental trauma, the affected teeth, diagnosis, state of root development at the moment of the injury, and emergency treatment performed (Table I). All the patients no presented previous history of other dental trauma. The clinical cases present a postoperative follow-up period from 17 to 24 months with amean of 20.2 months. **Case 1**. F.F.S., an 12-year-old boy with cerebral palsy by neonatal hypoxemia and hip dysplasia came to our paedodontics dental service because of a dental trauma at school one hour and forty minutes earlier. No consciousness and maxillo facial soft tissues compromised. Dental examination showed an extensive horizontal mesio-distal crown fracture at upper left maxillary central incisor (2.1) without pulp exposure, and with positive pulp thermal test and percussion test. His mother brought the coronal



Fig.1: Clinical view and radiographic control after 24 months (June 2007).

fragment into a glass of glucosaline solution. The first radiographic examination showed normal supporting structures, a complete root length with closed apex in the compromised tooth and absent of alveolar fracture at the traumatized area. Restorative and aesthetic treatment was performed immediately. First of all, with a smooth brush oral prophylaxis was made, enamel and dentine surface were cleaned with glucosaline solution and dried. Subsequent, coronal fragment was reattached by a composite adhesive technique. Both surfaces; coronal fragment and remnants of tooth were etched with conditioner gel and primed with Prime & Bond 2.1. TPH Spectrum (Dentsply; Petropolis-RJ/ Brazil) micro-hybrid composite resin was placed to match both tooth fragments and polymerized. Finally, the crown was polished with discs (Soft-lex - 3M ESPE). After 24 months follow-up period, the compromised tooth shows an excellent aesthetical and functional evolution (Fig. 1).

**Case 2.** J.B.Ch., an 8-year-old healthy boy, sustained fall down during sport activities at school. He was referred to our emergency room because a traumatic injury compromised both maxillary central incisors. The accident happened 3 hours and 30 minutes earlier. Extraoral and intraoral examination did not have significant information, neither soft tissues wounds nor alveolar bone fractures. There were evident signs of deep fractures of mesio-incisal angles, without pulp



exposure; both teeth presented normal mobility test and slightly sensitive response to cold stimulus. The radiograph showed an immature root formation with open apex. The teacher brought the coronal fragment inside of a napkin. The immediately treatment consisted in the reattachment of the fragment with composite resin technique (Fig.2).





Fig. 2. a) Radiographic examination after first emergency attention. Observe wide open apex and re-attached of both coronal fragments at upper maxillary central incisors (November 2005). b) Radiographic control after 11 months of coronal re-attachment (September 2006). c) Clinical aspect after 19 months follow-up period. The fragments are slightly decolorated ; Teeth are asymptomatic (April 2007).

**Case 3.** J.C.T., a 10-year-old boy with bilateral deafness sequel after meningococcal meningitis in October 2004 sustained a dental injury after fell down from stairs in his house. He arrived to our emergency dental service



4 hours after the accident, with no neurological compromised. At clinical examination, there were haematoma at the upper lip and deep crown fracture with pulp exposure at upper right maxillary central incisor (1.1). Radiographic examination confirmed the clinical diagnosis, and showed the compromised tooth with complete root development and absent of other damage at periodontal tissues. The emergency treatment consisted in Cveks' pulpotomy and temporary glass ionomer restoration (Fig.3). Two weeks later, after involution of upper lip haematoma, reattached of crown fragment with composite resin adhesive techniques was performed.

**Case 4.** N.M.R., an 8-year-old girl, was referred to our dental service after had been evaluated at Primary Health Service 48 hours earlier, because a dental injury after fell down from stairs at school. Clinical examination confirmed an extensive crown fractures in both maxillary central incisors. There were thin dentine layers over pulp chamber and high sensibility to cold and warm stimulus; normal mobility and percussion test. Both crown fragments did not find and recovered at the accident site. Initial radiographies confirmed the clinical diagnosis, and showed an immature root development with open apex in both compromised teeth (Fig.4). The immediate treatment consisted in calcium hydroxide indirect pulp protection and aesthetic composite-resin restoration.

**Case 5.** D.P.P., a 7-year-old boy, arrived to dental paediatric service because a dental injury affected both maxillary central incisors, after received a friends' pushed at school playground. After 1 hour with 40 minutes, the first examination was made and confirmed a little haematoma at the upper lip and bleeding of exposed pulp tissue at upper right maxillary central incisor (1.1). The neighbour tooth (2.1) presented crown fracture with exposed dentine, mobility, tenderness to percussion and 2 -3 millimetres of axial extrusion.

At radiographic examination, both teeth showed uncompleted root development and wide open apex, wide space of periodontal ligament at tooth 2.1, and confirmed the absent of root fracture. Is interesting to point out that coronal fragments were transported under the tongue of the affected patient. The emergency treatment consisted in: digital repositioning and wire-composite splinting at tooth 2.1; Calcium hydroxide partial pulpotomy at tooth 1.1. At both affected teeth fragment re-attachment were performed immediately with Prime & Bond 2.1. TPH Spectrum micro-hybrid composite (Dentsply-Brazil) (Fig. 5).

Fig. 3. a) Radiographic examination show deep complicated crown fracture with partial pulpotomy at tooth 1.1. b) Recall at 9 months of emergency treatment. There are no signs and symptoms of pulp complications (July 2006).





Fig.4. a) First radiographic examination that show 2 extensive and deep enamel-dentine fracture in both immature upper maxillary central incisors (January 2006). b) Radiographic control after 6 months of composite resin build-up restoration. Both teeth present normal root development and normality at supporting structures (July 2006). C) Radiographic and clinical appearance after 16 months. Observe complete root development and pigmentation of composite restorations (May 2007).

RESULTS

Five case reports about children with crown fractures were described giving details for different clinical situations and treatments. Total compromised teeth corresponded to 8 maxillary incisors; four right central



Fig. 5. a) Initial radiographic appearance of traumatized immature upper central incisors showing complicated crown fracture at tooth 1.1 and tooth 2.1 with crown fracture at incisal edge. Moreover, observe the width of periodontal ligament structures (August 2005). b) Immediate radiographic examination control after emergency treatment. Both coronal fragments were reattached. The teeth were repositioned and splinted (August 2005). C) Radiographic and frontal view after 22 months. New injury with the displaced of the coronal fragment one week earlier occurred (1.1). Both central incisors with closed apex and signs of partial canal obliteration. The reattached coronal fragments with clear signs of decoloration, and with no clinical complications and symptoms (June 2007).





incisors (1.1) and four left central incisors (2.1) in 4 males and 1 female. Two incisors presented at moment of the injury completed root formation, and the other six were incomplete root development with open apex. Six teeth presented uncomplicated crown fractures and two cases corresponded to complicated crown fractures. Two patients (case report 1 and 5) presented another concomitant lesion to support tissues (subluxation and extrusive luxation respectively). The causes of injuries were: fall (2), sport activity at school (1) and stairs fell down (2).

For case report n° one, two, three and five the time elapsed for the first emergency care were less than 4 hours after the injury; and case report # 4 received delayed treatment after 48 hours. Except the case report n° 4, the other ones recovered the coronal fragments at the site of the accident. After follow-up period range 17 to 24 months with a mean of 20.2 months, all of fractured teeth presented clinical and radiological signs of pulp survival (Table II).

Only in two case reports (4 and 5), a new emergency attention was required because displaced of composite restorations and coronal fragments. These fortuitous events were due to a new injury. In both patients, the compromised teeth presented normal response to thermal (warm and cold water) and percussion test, and normal structures at radiographic examination. So, the corresponding treatments were performed immediately.

To date, 6 maxillary incisors with enamel and dentine compromised present no pulp and periodontal ligament complications, equal to both maxillary incisors with partial pulpotomy. There are absent of pulp complications like pain to percussion test, spontaneous pain, crown discoloration and/or sinus tract on the vestibule. At radiographic examination recalls, the patients with crown fractures in immature teeth had shown continuity in root development, a clear sign of pulp survival. In this report, the aesthetic and functional treatments utilized were reattached of crown fragments and composite-resin build-up restorative technique.

#### DISCUSSION

Since March 2004, dental service of Regional Clinical Hospital, to associate with Dental Department of Faculty of Medicine of Universidad de La Frontera, in Temuco; Chile, South America, had been a research about prevalence and treatment of dental trauma in children and adolescents, and follow-up had been performed. This public health service receives patients by dental trauma from throughout the region. The most commonly identified forms of damage in young

AGE (years)	Sex	Cause of Injurie	Tooth	Diagnosis	Root Development	Emergency Treatment
12	Male	Fall	2.1	Uncomplicated Crown Fracture Subluxation	Closed Apex	Fragment Reattachment
8	Male	Sport	1.1-2.1	Uncomplicated Crown Fracture	Open Apex	Fragment Reattachment
10	Male	Stairs fell down	1.1	Complicated Crown Fracture	Closed Apex	Partial Pulpotomy Temporary glass Ionomer
8	Female	Stairs fell down	1.1-2.1	Uncomplicated Crown Fracture	Open Apex	Calcium Hydroxide indirect pulp protection Composite-resin
7	Male	Pushed	1.1	Complicated Crown Fracture	Open Apex	Partial Pulpotomy Fragment Reattachment Wire–composite Splint
7	Male	Pushed	2.1	Uncomplicated Crown Fracture Extrusive Luxation	Open Apex	Fragment Reattachment Wire-composite Splint

Table I. Description of patients attended because dental trauma with crown fractures in permanent incisors.

N° Patient	Tooth	Date of the injurie	Diagnosis	Time elapsed before first attention (min)	Follow-up (months)	Pulp Outcome	Radiographi c Images
1	2.1	8 Jun.2005	Uncomplicated Crown Fracture Subluxation	100	24	PS	
2	1.1	18 Nov. 2005	Uncomplicated Crown Fracture	210	19	PS	®
2	2.1	18 Nov. 2005	Uncomplicated Crown Fracture	210	19	PS	®
3	1.1	28 Nov. 2005	Complicated Crown Fracture	240	19	PS	
4	1.1	14 Jan. 2006	Uncomplicated Crown Fracture	> 24 hours	17	PS	®¥
4	2.1	14 Jan. 2006	Uncomplicated Crown Fracture	> 24 hours	17	PS	®¥
5	1.1	29 Aug. 2005	Complicated Crown Fracture	100	22	PS	®¥
5	2.1	29 Aug. 2005	Uncomplicated Crown Fracture Extrusive Luxation	100	22	PS	®¥

Table II: Clinical and radiographic outcome of anterior teeth with treatment by crown fractures. PS: Pulp survival; PN: Pulp necrosis; ®: Normal root development and closed apex; ¥: Slight Pulp canal obliteration.

permanent teeth have been fracture to enamel and enamel-dentine, similar to the findings in several others studies (Flores *et al.*; Traebert *et al.*; Petti & Tarsitani; Marcenes *et al.*, 1999; Marcenes *et al.*, 2000; Hamilton *et al.*, 1997a; Tovo *et al.*; Tapias *et al.*; Altay & Gungor, 2001). Also principal causes of dental trauma are similar too; falls, sport activities, bicycle accidents and striking with objects.

Nowadays, aesthetics solution because crown fracture in maxillary permanent incisors in children and adolescent is of utmost importance to the patient and to the dentist. Therefore, paediatric dentists can not neglect the importance of biological, functional and aesthetic elements in the treatment of this pathology. They must be sensitive in regard to new developments techniques, in order to choose appropriate treatment, materials and report the limitations to the affected.

The diagnosis is essential and made by clinical examination of missing tooth structure from the crown. Commonly, the compromised tooth presents positive response to thermal test examination because of the oral exposition and pressure of sectioned and dehydrated dentinal tubules. The crown may be with dark discoloration, especially when the tooth presents damage to periodontal tissues. In case report 5, in upper left maxillary central incisor, instead of severe extrusive luxation, the fast and adequate repositioning and splinting have allowed optimal pulp revascularization and healing of periodontal ligament fibers, without crown discoloration.

The dentin-predentin complex, the avascular, mineralized, connective tissue which constitutes the major part of the tooth reacts to physiological and pathological processes. Its most important characteristic is the presence of dentinal tubules which extended peripherally from odontoblast-predentin junction throughout the thickness of the tissue. In crown fractures, dentine exposes the tubules and leaves its contents, inter and peritubular uncovered (Mjôr, 1985; Thomas, 1985; Cuicchi *et al.*, 1995). The sensitivity increase in younger teeth, closer to the pulp chamber, as the number and diameter of the tubule increase. After the trauma, bacteria have the potential to invade sectioned dentinal tubules and therefore produce acute inflammation and pulp

necrosis. Nevertheless, in young permanent crown fractured incisors, there are a great vascular and cellular pulp tissue, with several defense mechanism and high potential of healing.

Firstly, an outward flow of dentinal fluid due to positive pulp pressure, who resist bacterial invasion; and secondly immediate inflammatory response to stimuli, bacterial toxins or bacterial intrapulp circulation (Cuicchi et al.). In these case reports, majority of patients were attended the same day of the accident, before of four hours to favor and protect the pulp tissue of bacterial-toxins invasion through of dentinal tubules. As a result, after 24 months followup period, none of fractured incisors have presented clinical and radiological signs of pulp necrosis and complications. In relation to prognosis of crown fractures, there are several studies that have shown the limited risk of pulp necrosis as long as no additional damage to support tissues has occurred. Delayed treatment of teeth with uncomplicated crown fractures and without luxation injuries had shown no relationship to pulp complications, inclusively. Nevertheless, other researches had shown an increase in frequency of pulp necrosis, if the treatment was initiated after 3-4 days of the injury (Andreasen & Andreasen; Cavalleri & Zerman; Andreasen et al., 2002).

Furthermore, any other factors may affect the protect mechanism of the pulp, such as commotion of pulp circulation, and the potential of pulp repair (luxation injuries and age of the teeth). The continuation in root formation and in some cases, partial calcified of pulp chamber, are the best signs of pulp survival after the crown fracture.

The inflammatory phenomenon usually is transient as long as bacterial infiltration is prevented and pulp vascularization remains intact. In this context, an earlier and suitable first emergency attention to achieve a correct sealing of dentinpredentin and pulp complex is of the greatest importance. In other research in primary teeth, inflammatory infiltration as a response to traumatically pulp exposed is localized at pulp chamber, and not compromised all pulp tissue (Raslan & Wetzel, 2006).

Currently, after traumatic crown fractures in permanent incisors the dentin-pulp complex prognosis is good. Nevertheless, for this purpose some factors should be considered; properly and adequate handled and management of the dentin pulp complex after traumatic complicated or uncomplicated crown fractures is the utmost importance to achieved a good functional and aesthetical outcome.

When fragment is retrieved at the site of the accident, the first choice of treatment of coronal fractures is immediate reattachment of the fragment. This technique are becoming attractive because new dentin bonding agents (Olsburgh et al.). Nevertheless, some clinical considerations should be done before to perform it : (i) compromised tooth with supra-gingival fractured margin, (ii) intact fragment with good adaptation, (iii) not support tissues affected (luxation injuries) and the fragment with correct stored (Rappelli et al., 2002). If it not possible, composite-resin restoration should be done. The first one can be considered the most functional, conservative and aesthetic treatment modality for crown fractures of maxillary incisors. Its advantages are: (i) psychological ones, (ii) short time of treatment, (iii) exact morphology and texture, (iv) aesthetics, (v) wear similar to adjacent/opposed teeth, (vi) color match to the remnant crown, (vii) preserved incisal translucency and tooth contours and (viii) delay in the "prosthetic restoration" for young patients (Olsburgh et al.; Murchinson et al.). The treatment is more complex and questionable in presence of multiple tooth fragments.

Ideally, the fragment should be place in a hydrated medium (water, saliva, physiologic solution), to avoid discoloration and dehydration (Andreasen & Andreasen; Rappelli *et al.*). In the cases related before, the first two patients with re-attachment of fragments have not presented discoloration and dehydration still; in these cases, the fractured fragments were transported in glucosaline solution and in a napkin respectively. In patient number three, after two weeks fragment repositioning was performed, because presented complicated crown fractured. In this time, fragment into physiological solution was stored to avoid discoloration and dehydration.

The use of dehydrated tooth fragment not achieves the aesthetic desire effect, or it will be less than ideal. In case report 5, the coronal fragment was re-reattached after 7 days of the second dental trauma. The fragment was stored firstly into a glass of water, and secondly into a napkin. Nowadays, this fragment presents discoloration and dehydrated signs.

Currently, the literature shows different reattachment techniques, and there is no agreement about which one are the best (bevels, chamfers, enamel and/or dentine grooves). Usually, the choice of the technique is mostly empirical (Murchinson et al.; Demarco et al., 2004). Obviously, there are diverse opinions in regard to whether technique improves the fragment resistance to re-fracture and/ or displacement (Demarco et al.; Farik et al., 2002). Some researches have shown that the best resistance of re-attachment fragment is found in 1-2 mm circumferential bevels and/or chamfers, and with internal grooves (Demarco FF et al., 2004). The material for bonding the fracture fragment is controversial too; Andreasen et al. (2002) had shown that adhesive bonding agents always should be used in conjunction with resin in order to obtain the best functional strength (Andreasen et al., 1993). In all of cases with crown fragment reattachment, 1-2 mm circumferential chamfers were performed to improve the resistance.

Farik *et al.* showed that most fifth-generation dentin bonding adhesives with an unfilled resin increase the fracture resistance or re-attached coronal fragments with the tooth remnant . In our case reports with re-attachment of crown fragment Prime & Bond 2.1 and TPH Spectrum micro-hybrid composite resin (Dentsply; Petropolis-RJ/ Brazil) were used, and to date, after 24 months follow-up period they have had two cases of fragments displaced by new dental trauma. The fragment loss can be due to: (i) another traumatic injury, (ii) non physiologic oral functions in the patient and/or clear evidence of bruxism and (iii) inadequate restorative techniques (Andreasen *et al.*, 1995).

Composite-resin restoration build-up presents the major challenge to the clinicians, because to reestablish aesthetics, shade, form, dimensions, opacity and translucency of the fractured tooth. Frequently, composite restoration present difficulties to match the color and will show higher wear than enamel structure (Olsburgh *et al.*; Rappelli *et al.*; Murchinson *et al.*). Nowadays, with the latest development of adhesive systems and composite-resin materials, we can expect more longevity of the composite-resin buildup restoration. The principal reasons of failure are: (i) bond failure, (ii) marginal failure, (iii) discoloration, (iv) fracture of composite and (v) shade instability (Olsburgh *et al.*).

In case report 4 after 15 months because a new injury, the composite resin restoration were displaced. In spite of extended and deep fracture, the affected teeth presented positive response to warm and cold stimulus, and radiographic examination showed continuity in root development.

In younger and teen-age patients, prosthodontic restoration, laminate veneers or fullcoverage restorations of young permanent fractured maxillary incisors is contraindicated and questionable, because (i) the sacrifice of healthy tooth structure, (ii) large pulp size, (iii) stage of dentition development, (iv) in some cases, previously orthodontic treatment is needed, (v) progressive eruption (vi) gingival margin instability and (vii) higher costs (Murchinson *et al.*).

Nowadays, with the evidence dental based in the literature, crown fractures in permanent teeth have a good to excellent prognosis to the pulp. For uncomplicated crown fractures dentinal tubules is needed to prevent bacterial invasion. For crown fractures with exposure pulp, partial pulpotomy with CaOH is the choice treatment. Also, the evidence at the literature, confirm the first choice of treatment for anterior crown fractures: re-attachment of coronal fragment and secondly resin-composite restoration.

DIAZ, J. A. Fracturas coronarias en incisivos centrales maxilares; seguimiento de 2 años y resultado clínico en niños. *Int. J. Odontostomat., 2(1)*:83-94, 2008.

**RESUMEN**: El propósito de este estudio es mostrar los resultados de tratamiento por fracturas coronarias complicadas y no complicadas en incisivos centrales maxilares, en un grupo de 5 niños entre 7 y 12 años. Fue realizada una descripción de una serie de 5 casos. Los dientes afectados fueron restaurados con la técnica de reposición de fragmento y/ o restauración coronaria con composite. Los pacientes han sido citados a control durante un periodo de seguimiento de 24 meses. Todos los dientes comprometidos han presentado una evolución clínica y radiográfica adecuada. Desde el punto de vista estético, el resultado lo consideramos satisfactorio. El adecuado tratamiento de esta patología, requiere necesariamente tener el conocimiento sobre aspectos de diagnóstico, planificación de tratamiento, aspectos biológicos, estéticos, funcionales y económicos. Actualmente existe una enorme evidencia que el pronóstico pulpar, restaurador y estético para esta patología es muy bueno, y que ha mejorado considerablemente en los últimos años. En condiciones ideales, es necesario realizar una atención de urgencia inmediata para evitar y disminuir el riesgo de invasión bacteriana del complejo dentino-pulpar .

PALABRAS CLAVE: fracturas coronarias en niños, reposición de fragmento, reconstrucción coronaria composite.

## REFERENCES

- Altay, N. & Gungor, H. C. A retrospective study of dentoalveolar injuries of children in Ankara, Turkey. Dent. Traumatol., 17:201-4, 2001.
- Andreasen, J. O. & Andreasen, F. M. Textbook and color atlas of traumatic injuries to the teeth. Copenhaguen, Munksgaard, 1993. pp.216-56.
- Andreasen, J. O.; Andreasen, F. M.; Skeie, A.; Hjorting-Hansen, E. & Schwartz, O. Effect of treatment delay upon pulp and periodontal healing of traumatic dental injuries-a review article. Dent. Traumatol., 18:116-28, 2002.
- Andreasen, F. M.; Noren, J. G.; Andreasen, J. O.; Engelhardtsen, S. & Lindh-Stromberg, U. Long-term survival of fragment bonding in the treatment of fractured crowns: a multicentre clinical study. Quintessence Int., 26:669-81, 1995.
- Andreasen, J. O. & Ravn, J. J. Epidemiology of traumatic dental injury to primary and permanent teeth. Int. J. Oral Surg., 1:235-9, 1972.
- Andreasen, F. M.; Steinhardt, U.; Bille, M. & Munksgaard, E. C. Bonding of enamel-dentine crown fragments after crown fracture. An experimental study using bonding agents. Endod. Dent. Traumatol., 9:111-4, 1993.
- Borssén, E. & Holm, A. K. Treatment of traumatic dental injuries in a cohort of 16-years-olds in northern Sweden. Endod. Dent. Traumatol., 16:276-81, 2000.
- Borum, M. K. & Andreasen, J. O. Therapeutic and economic implications of traumatic dental injuries in Denmark: an estimate based on 7549 patients treated at a major trauma centre. Int. J. Paed. Dent., 11: 249-58, 2001.
- Cavalleri, G. & Zerman, N. Traumatic crown fractures in incisors with immature roots; a follow-up study. Endod. Dent. Traumatol., 11:294-6, 1995.
- Cuicchi, B.; Bouillaguet, S. & Holz, J. Dentinal fluid dynamics in human teeth in vivo. J. Endod., 21:191-4, 1995.
- Demarco, F. F.; Fay, R. M.; Pinzon, L. M. & Powers, J.

M. Fracture resistance of re-attached coronal fragments-influence of different adhesive materials and bevel preparations. Dent. Traumatol., 20:157-63, 2004.

- Farik, B.; Munksgaard, E. C.; Andreasen, J. O. & Kreiborg, S. Fractured teeth bonded with dentin adhesives with and without unfilled resin. Dent. Traumatol., 18:66-9, 2002.
- Flores, M. T.; Onetto, J. E. & Garvarino, M. L. Dental Trauma in Children and Adolescents in Valparaiso, Chile. Endod. Dent. Traumatol., 10:1-5, 1994.
- Hamilton, F. A.; Hill, F. J. & Holloway, P. J. An investigation of dentoalveolar trauma and its treatment in an adolescent population. Part I: The prevalence and incidence of injuries and the extent and adequacy of treatment received. Br. Dent. J., 182:91-5, 1997.
- Hamilton, F. A.; Hill, F. J. & Holloway, P. J. An investigation of dentoalveolar trauma and its treatment in an adolescent population. Part II: Dentist's knowledge of management methods and their perceptions of barriers to providing care. Br. Dent. J., 182:129-33, 1997.
- Lombardi, S. M.; Sheller, B. & Williams, B. J. Diagnosis and treatment of dental trauma in a children's hospital. Ped. Dent., 20(2):112-21, 1998.
- Marcenes, W.; Beiruti, N.; Tayfour, D. & Issa, S. Epidemiology of traumatic dental injuries to permanent incisors of school children aged 9-12 in Damascus, Syria. Endod. Dent. Traumatol., 15:117-23, 1999.
- Marcenes, W.; Alessi, O. N. & Traebert, J. Causes and prevalence of traumatic injuries to the permanent incisors of school children aged 12 years in Jaragua do Sul, Brazil. Int. Dent. J., 50:87-92, 2000.
- Mjôr, I. A. Dentin-predentin complex and its permeability: Pathology and Treatment Overview. J. Dent. Res., 64:621-7, 1985.
- Murchinson, D. F.; Burke, J. T. & Worthington, R. B. Incisal edge reattachment: indications for use and clinical technique. Br. Dent. J., 186:614-9, 1999.

- Olsburgh, S.; Jacoby, T. & Krejci, I. Crown fractures in the permanent dentition; pulpal and restorative considerations. Dent. Traumatol., 18:103-15, 2002.
- Petti, S. & Tarsitani, G. Traumatic injuries to anterior teeth in Italian schoolchildren:prevalence and risk factors. Endod. Dent. Traumatol., 12:294-7, 1996.
- Rappelli, G.; Massaccesi, C. & Putignano, A. Clinical procedures for the immediate reattachment of a tooth fragment. Dent. Traumatol., 18:281-4, 2002.
- Raslan, N. & Wetzel, N. E. Exposed human pulp caused by trauma and/or caries in primary dentition: a histological evaluation. Dent. Traumatol., 22:145-53, 2006.
- Tapias, M. A.; Jimenez-Garcia, R.; Lamas, F. & Gil, A. A. Prevalence of traumatic crown fractures to permanent incisors in a chilhood population, Móstoles, Spain. Dent. Traumatol., 19:119-22, 2003.
- Thomas, H. F. Dentin-predentin complex and its permeability: Anatomical Overview. J. Dent. Res., 64:607-11, 1985.
- Traebert, J.; Peres, M. A.; Blank, V.; Bôell, R. S. & Pietruza, J. A. Prevalence of traumatic dental injury and associated factors among 12-year-old school children in Florianópolis, Brazil. Dent. Traumatol., 19:15-8, 2003.
- Tovo, M. F.; dos Santos, P. R.; Kramer, P. F.; Feldens, C. A. & Sari, G. T. Prevalence of crown fractures in 8-10 years old schoolchildren in Canoas, Brazil. Dent. Traumatol., 20:251-4, 2004.

Correspondence to: Jaime Andrés Díaz Unidad Odontopediatría, Departamento Odontología Integral, Facultad de Medicina, Universidad de La Frontera. Manuel Montt 112, 4º piso, Casilla 54-D Temuco - CHILE

Phone: 56-45-325776 Fax : 56-45-325777

Email : felicar@hotmail.com

Received: 26-05-2008 Accepted: 13-06-2008