Fractured First Upper Pre-Molar Restored with Resin Composite

CASE REPORT

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ABSTRACT
The lack of knowledge of the biomechanical response of a vital tooth restored with composite makes the practitioners tend for full coverage instead of a partial restoration. The purpose of this article is to show that a large composite restoration on a vital tooth is always possible. Although the risk of fracture of the remaining enamel walls, even if they are well supported, is relatively high. The line of the fracture, because the tooth is still vital, should stay above the pulp chamber. No other fracture at the root level was observed. Three years later the tooth is still functional.

KEYWORDS
Cracked tooth, Dental restoration, Bonding composite.

INTRODUCTION
Unlike what is known, teeth are not rigid structures; they undergo deformation during normal loading, and lead in some situations to weaken or even to lose parts. The main factors that contribute to common tooth fracture are: masticatory accidents, such as biting on a hard, rigid object with unusually high force, or excessive removal of tooth structure during cavity preparation, extensive composite restorations placed without due care for incremental technique, as well as large Class II OM and MOD restorations that produce obvious deformation.

By definition, tooth fracture is a fracture plane of unknown depth and direction passing through tooth structure, while infraction is when the crack line is limited only to the enamel the most commonly affected teeth are mandibular second molars, followed by mandibular first molars and maxillary premolars.

J. Edward Ailor JR has classified fractures into vertical or oblique. Vertical fractures are located midtooth, usually running in a mesiodistal direction, although buccolingual vertical fractures do occur. Oblique fractures normally originate at the internal line angles of intracoronal preparations and result in cuspal fracture, with or without root involvement.

According to Lynch C et al. management options of a cracked tooth vary according to clinical need, from replacement of the fractured cusp with a simple restoration to placement of an extracoronal restoration with adequate cuspal protection.

CASE REPORT
This article is a case report of a fractured first upper pre-molar that held a critically composite restoration for almost 5 years.

The following case compared the bonding resistance throughout the years between dentin and enamel. A 41-year-old female exhibited discomfort at the upper left maxillary region.

She was having pain especially when chewing tough foods and often something as innocuous as salad, and sudden onset of acute sensitivity to thermal changes, always to cold and sometimes to heat.

The clinical examination revealed a horizontal line of crack at the palatal side of the tooth (Fig 1).

No other fracture was detected after a circumferential periodontal probing of the sulcus. The gum around the tooth looked healthy.

Although various fracture detection devices test individual cusps to localize fractures, biting on cotton rolls is considered the simplest method and it revealed the same pain described by the patient. X-ray under magnifying loupes clarifies the diagnosis by exposing the fracture line and its extent (Fig 2) even though a radiograph is not the primary diagnostic aid for locating fractures.

Primary Treatment
Like any other treatment, the fractured part should be
eliminated in order to relieve pain.

It is well known that Pressure applied to the crown of a cracked tooth leads to separation of the tooth components along the line of the crack. As a result, the whole crown, while removing the existing old restoration with a regular-grit diamond bur (Diamond Point FG, #104R, Shofu, Kyoto, Japan) in a high-speed hand piece under copious water spray, is detached taking off the buccal cusp with it (Fig 3).

Less than 25% of the detached fragment is composed of enamel and the rest is resin composite (Fig 4). The enamel is fractured before it can detach from the residual composite.

On the other hand, the rest of the tooth shows a sclerotic pigmented dentin due to an old amalgam restoration (Fig 5). No evidence of any caries or residual composite material is visible. The fracture pattern shows a complete debonding of the restoration from the dentin.

Since partial restoration of the tooth with a composite is not feasible anymore; the patient is referred to a prosthodontist for full crown coverage.

Two weeks later endodontic treatment was performed and a metal screw was cemented. Then one month later the final crown was placed.

Figure 6 shows a 3 years follow up of the adaptation of the crown. The tooth is still functional.

**DISCUSSION**

Posterior teeth, particularly maxillary premolars, have an anatomic shape that makes them more susceptible to cusp fractures when under occlusal load. Premolars are more brittle when subjected to lateral forces during mastication.

The type and quality of the remaining structure also has an influence on fracture resistance when the tooth is submitted to load application.

When the width of the intracoronal preparation of a posterior tooth exceeds one third of the intercuspal width, the tooth becomes significantly more susceptible to cuspal fracture and the concern becomes not only restoration failure but also tooth fracture.

Cavities of large size (a facio-lingual dimension of more than two thirds of the distance between cusps) had been judged to require cusp covering.

Thus, direct composite restorations are commonly used for small posterior restorations and are not recommended for large ones especially in regions with high masticatory forces.

Although a cusp reduction of at least 1.5mm is recommended in extensive premolar restorations. The fractured tooth shows no reduction of the buccal cusp.
and yet it remained functional for more than 5 years. Considering all of these factors, it looks obvious that the restoration of such fractured tooth is considered a successful since it lasted 5 years. The only reason that defends such treatment is the vitality of the tooth, since Dehydrated human dentin (like endodontically treated tooth) demonstrates lower strain values at fracture than hydrated dentin. The mean value of Young’s modulus of elasticity and the proportional limit in compression appears lower in pulpless teeth than in teeth with pulp. The pulps of human teeth have been found to contain mechanoreceptors that are used to subconsciously limit the maximum biting force and consciously detect differences in the hardness of the objects being chewed.\(^{10}\) Finally, it holds the fracture location above the pulp chamber at the lowest resistant wall which is in our case the floor of the restoration. No other fracture was observed in the remaining tooth especially at the level of the root for the last 3 years following the placement of the crown, means that the original fracture of the cusp was limited above the pulp chamber (Fig 7).

In this case the failure mode observed was the debonding of the restoration at the dentin bonding interface, this could be explained by the difference in the resistance fatigue with time of the bonding agent between enamel and dentin. Moreover, the resistance fatigue of the bonding agent with enamel is much better than the glasslike dentin (Fig 5), because it has a morphological and structural transformations, induced by physiologic and pathologic processes, resulting in a dentinal substrate that is less receptive to adhesive treatments than is normal dentin.\(^{6}\)

CONCLUSION
Diagnosing discomfort sometimes could be tricky. The practitioner must take into consideration among the other causes of pain the possibility of a tooth fracture, especially when patients complain of pain or discomfort while chewing or biting. A typical examination starting with the history to the clinical and radiographic inspection, finalized with specialized tests could be conclusive. Dependent on the type of the fracture, treatment could vary from partial (Composite, amalgam) to a full covered tooth restoration mainly when no more healthy residual structures are left. Based on a systematic examination and the awareness of the problem, the practitioner should have no difficulty diagnosing and managing pain caused by a fractured tooth.

REFERENCES