Reattachment of fractured teeth using adhesive composite resins: The aesthetic need.

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Abstract:
Nanotechnology combined with advanced resin bonding agents has succeeded in improving aesthetic restoration and repair of fractured tooth fragment creating a dynamic smile change in a single appointment that is usually very communicable and stress relieving for the patient. Yilmaz Y. and Guler C. reported restoration of 99 fractured teeth with reattaching the fragments to its tooth remnant with composite resin with no significant change in the colour, bond strength in a 2 year follow up. This clinical report describes the immediate functional and aesthetic reattachment of a female patient’s anterior tooth piece that fractured and was preserved. Within a few hours of the accident the tooth was restored to form and function that the patient willingly accepted.

Key words: Reattachment, Fractured, Aesthetics, Nanotechnology, Synergy.

Introduction:

Certain clinical considerations present themselves with the need of the hour. Emergency aesthetic reconstruction and reattachment of fractured teeth to predictable tooth form, function, smile in the choicest and predictable manner is possible very satisfactorily due to the advancements in adhesive direct composites. Correction of fractured anterior crowns has been possible by various options including full ceramic crowns, ceramic veneers, pin retained resin restorations, basket crowns, composite resins with acid etch adhesive techniques. Studies⁵ have revealed that fragment bonding with adhesive resins results in maintaining the patient’s own natural and translucent enamel, preservation of pulp vitality, economical and less time consuming. Contemporary adhesive bonding and techniques has brought a shift in today’s practice by maximizing necessity, quality and efficiency with excellent aesthetic results.

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Case Presentation:

It is a presentation of an aesthetic approach to recreate the smile in a female patient complaining of sudden fracture of anterior tooth leading to an aesthetic, functional, and psychological breakdown.

History and Treatment Planning:

A 55 year old patient reported with a broken mandibular central incisor from the middle third (Fig.1).

Fig 1 Broken mandibular central incisor

She had fortunately preserved the broken piece that was handed to the clinician in one piece. Being very conscious she refused to smile and was socially uncomfortable. Primary concern of the patient was immediate aesthetic restoration to avoid social embarrassment. The fracture line of the remaining tooth extended into the dentin but did not involve the pulp. The patient reported no pain and discomfort from the tooth which responded normally to vitality testing. Radiographic assessment showed no pulpal involvement and sound bone support. Intraoral assessment of the gingiva showed normal healthy gingival. The occlusal relationships had normal over jet and overbite with no signs of trauma in the adjacent teeth.

The broken portion when placed over the remaining part of 41 it fitted as a jig-saw puzzle. Considering the fact that it was a vital tooth with enough enamel for bonding labially and lingually in the broken portion and 41 it was decided to conservatively seal the two portions after acid etching and adhesive bond application with flow resin and then layered with direct composite resin.

Treatment:

The broken portion and the remaining 41 was cleaned with a prophylaxis rubber cup using slurry of pumice gently at slow speed. A thin layer of glass ionomer liner was placed on the exposed dentin surface of 41 to prevent any further irritation to the pulp due to acid etching. For optimal anterior aesthetics and polishability composites with nano particles were preferred. After the initial analysis of the existing colour, with the assistance of the shade guide synergy D6 universal enamel (Coltene Whaledent) was chosen, that had the required translucency and shade matching. Proper isolation with cotton rolls and saliva ejector was done for salivary control to prevent the etched enamel and dentin from being contaminated resulting in reducing the available bond strength.

The surfaces of 41 and the preserved broken portion was acid etched with 37 % phosphoric acid gel for 15 seconds (Fig 2, Fig 3).
They were then rinsed thoroughly with copious water for 15 seconds and dried with paper towel. According to the wet bonding technique two layers of Single Bond (3M) was applied on the etched surfaces. First layer of the bonding agent was applied and after 10 seconds it was thinned gently by air blow for 3 seconds. The second layer was immediately applied and thinned for three seconds. The bonding agent was light cured to obtain a shiny and glossy surface. Thin layer of Tetric Flow was applied with the flowable composite syringe to the fractured surfaces and the margins of 41 and the broken tooth piece so that the low viscosity flowable resin could flow into the voids and defects. The broken piece was placed on 41 and cured for 30 seconds each from labial, lingual, mesial and distal directions ultimately joining the two together in a definite anatomical tooth shape and size. Transparent matrices were held in place proximally with wedges to prevent the flow of resin to the adjacent tooth and build proper proximal contour and contact.

From the recent composites Synergy D6, enamel universal shade (Coltene Whaledent) a nano composite was used to apply a thin layer to the lingual surface with the Teflon coated instrument and spread anatomically. It was cured for 60 seconds and then the labial surface was layered with a thin layer of enamel resin (Nanocomposite SynergyD6). Proximally resin was applied and the contact restored. Labially the contour and surface texture was created with a brush and polymerized. Symmetry was restored to the anterior dentition according to the patient’s expectation and relief (Fig 4).

The finishing and polishing kit from Shofu was used to adjust the surface gloss and micromorphology of the tooth to that of the adjacent teeth. High gloss polishing was done with silicon-carbide impregnated brushes. Occlusion was evaluated with articulating paper to adjust it free of contact with the apposing tooth. The radiographic follow up did not show any irregularities. Patient was recalled after four weeks. Examination of tooth shade, occlusion and vitality were considerably normal.

Discussion:

Krasti G[5] studied crown-root fractures and concluded that reattachment of the fractured tooth fragment is possible using current composite materials when the fracture margins are supragingival with coronal tooth structure intact. Mithra NH[6] evaluated the compressive strength of nanocomposites in comparison with microhybrid composite. Microhybrid composites have 50 wt % of inorganic phase as compared to 80wt% for the nanofilled thus increasing their contact surface and improving their mechanical behavior. The study concluded that owing to reduced dimension of the particles and wide distribution an increased occlusal load can be achieved with nanocomposites thus increasing their mechanical properties such as tensile strength, compressive strength and other mechanical properties.

The recent advances in nanotechnology have been able to significantly improve the mechanical properties and polymerization shrinkage of dental composites providing unique physical, mechanical, and optical characteristics. Nanocomposites[4] consist of two types of nanofiller particles: a) Nanomeric (NM) particles are silica based made from aqueous colloidal silica sols with a diameter of .20 and 75 nm treated with 3-methacryloxypropyltrimethoxysilane (MPTS) a coupling agent allowing chemical bonding of the NM filler to the resin matrix during curing. b) Nanoclusters (NC) – the first type of (NC) ranges from 2 to 20nm and the second are spheroidal with 0.6 µm
average particle size distribution. Both types of nanocluster filler particles are treated with an (MPTS) coupling agent that lowers the possibility of voids.

On the basis of a study by Gogna[4] the compressive strength of Filtek Z-350 a nanocomposite ranged from 316.08-460.35 MPa while for Synergy D6 it ranged from 460.19-597.92 MPa that is better than the hybrid, microhybrid and microfilled composites. It can also be concluded that higher compressive strength provides higher fatigue limit. When choosing from the various nanocomposites for clinical use the study states that Synergy has 83% w/w or 65% vol of the filler content according to the manufacturer that is more in comparison with the other two tested nanocomposites, resulting in highest compressive strength and the lowest microleakage scores for Synergy D6 in comparison to Filtek350 (3M) and Grandico (voco) thus restoring the tooth to its optimal strength with low post-operative sensitivity.

Advancements in filler particle size, particle size distribution and morphology and monomer technology has been the introduction of low-viscosity flowable composites that promotes the flow and intimate adaptation to prepared tooth surfaces. Their applications include most popularly as a conservative restoration and a repair resin for margins.

This technique requires competitive skill in proper conditioning of the enamel surface by acid etching to expose the inorganic crystalline component of enamel creating a 5 – 10μm porous layer. Single Bond (3M) a recently developed material containing HEMA, Bis GMA, dimethacrylate resin and a unique methacrylate functional copolymer of polyacrylic and polyitaconic acids in water and ethanol solvent base relies on wet bonding technique to provide bond strength of 17MPa – 24MPa. On application on wet dentin the water from the primer diffuses into the deminerised dentin matrix and tubules and the resin monomer moves further around the collagen fibrils.

Advancements in ‘Lasers’ are also proving effective for enamel/dentin etching prior to restorative material placement. CO2 and Nd: YAG laser etching is a process of continuous vaporization and microexplosion due to vaporization of water trapped within the hydroxyapatite matrix. However more studies are needed for frequent treatment options.

**Conclusion:**

Finally the patient felt socially comfortable and could take away a beautiful smile. It is definitely a valuable addition to the various treatment options.

**References:**


