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Structural Redemption- Rebuilding A Fractured Tooth Using Interlig Fibres: A Case Report

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Abstract
The rehabilitation of structurally compromised endodontically treated teeth remains a significant clinical challenge, given their substantially higher fracture susceptibility compared to vital teeth. Traditional approaches employing cast post-and-core systems with full-coverage restorations often exacerbate tooth weakening and predispose to root fractures. To address these limitations, contemporary minimally invasive techniques utilizing fibre-reinforced composite materials have emerged as a viable alternative. These innovative biomimetic solutions effectively restore lost dentin structure, enhance mechanical strength, and reduce the need for extensive prosthetic interventions. This case report demonstrates the clinical application of fiber-reinforced composite system for reinforcing endodontically treated teeth followed by the placement of a full coverage lithium disilicate restoration.
Keywords- *ceramics, fibre-reinforced composite, interlig, lithium disilicate*

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I. Introduction

The prognosis of endodontically treated teeth is influenced by several factors, with coronal restoration being a key element in ensuring their long-term success [1].

Restoring endodontically treated teeth (ETT) with cracks, widened roots, or compromised tooth structure is a common yet challenging procedure in dentistry [2]. These teeth often experience tissue loss due to factors such as decay, endodontic access preparation, canal instrumentation, placement of metal posts, procedural errors, and extensive restorations. Such interventions can result in the deterioration of critical anatomical features, including enamel and marginal ridges. Consequently, these teeth are far more susceptible to fractures compared to vital teeth [3].

Research indicates that root canal treatment itself does not inherently weaken the tooth, as it reduces tooth stiffness by only about 5% [4]. However, other factors—such as the use of chemicals and intracanal medications between appointments—can alter the tooth's structural integrity, further diminishing its fracture resistance [5].

Modern adhesive dentistry, utilizing advanced resin bonding systems and composite materials, enables the placement of more conservative, durable, and aesthetically pleasing restorations. These restorations are cost-effective and can often be completed in a single appointment [1]. Use of fibre-reinforced composites (FRC) in ETT should be included as an alternative contemporary restorative technique, one example is Interlig (Angelus, Londrina, Brazil).

Lithium disilicate (LS2) ceramics are the most commonly utilized materials for chairside restorations, valued for their excellent balance of aesthetics and durability, making them a widely preferred choice in dental practice [7].

This case report describes the use of FRC in an endodontically treated tooth with weakened walls and additional reinforcement using an LS2 crown.

II. Case Report

A 27-year-old female patient reported to the Department of Conservative Dentistry and Endodontics with a presenting complaint of a fractured tooth in the lower right front tooth region since 2 weeks. Patient elicited a history of a mobile crown that dislodged 3 weeks ago. The previous crown was a porcelain fused to metal crown.

Patient also gave a history of initiation of endodontic treatment elsewhere but could not continue the treatment further.

Clinical Examination

On intraoral examination, carious labial perforation of 31 was noted. Tooth preparation along with an incompletely restored access cavity was noted on 41. 42 had an access cavity that was temporarily restored [Fig 1(a)].

Radiographic Examination

Radiographic evaluation showed incomplete endodontic treatment on 31 and 41. Presence of intracanal material was noted inside 41. Apical calcification of the canal was noted on 31. Fast-break appearance was noted on 42, suggestive of 2 canals [Fig 1(b)].

(a) (b)

Fig 1. Pre-op photograph and radiograph

III. Treatment

After a round of oral prophylaxis, the treatment proposed to the patient was to complete endodontic treatment and post-endodontic restoration of 31 and 42 and post-endodontic restoration followed by crown on 41.

Continuation of endodontic treatment was initiated on 31, 41 and 42. Caries on the labial perforation was removed and the perforation was repaired using composite. The access cavity was modified on 41 and 42. Intracanal material was removed from 41 through copious irrigation. Working length was established on 31 and 41 (Fig 2). Apical calcification was noted on 31. The patient was informed about the same and also regarding the complexity of treating 42 in the same appointment. The patient agreed on completion of endodontic treatment on 31 and 41 and did not express interest on continuing treatment on 42.

#41- Cleaning and shaping were done on 41 using rotary files (GenEndo, Coltene) upto 35-6% accompanied by copious irrigation using 5.25% NaOCl (Coltene) and EDTA. Master cone was selected (Fig 3) and obturation was completed using Bio-C bioceramic sealer (Angelus, Londrina, Brazil) (Fig 6).

#31- To achieve a complete glide path and a line of patency of the canal, re-negotiation was carried out using #10 D-finder files which was supplemented by copious irrigation using 17% EDTA. Radiographs were repeatedly taken to verify if complete canal patency was achieved. After negotiation of the apical calcification, working length radiograph was repeated. Patency was achieved till 2mm short of the apex. Attempts to negotiate further did not lead to complete achievement of patency. This working length was finalized (Fig 4), and chemo-mechanical preparation was done upto 25-6% using rotary files (GenEndo, Coltene) accompanied by copious irrigation using 5.25% NaOCl (Coltene) and 17% EDTA. Master cone was selected (Fig 5) and obturation was completed using Bio-C bioceramic sealer (Angelus) (Fig 6). Access restoration was done using composite (Tetric-N-Ceram, Ivoclar Vivadent).

In the subsequent appointment, the treatment plan was to place FRC and complete the tooth preparation followed by impression on 41.

The pre-determined length of the Interlig (Angelus, Londrina, Brazil) fibre was cut. The base of the access cavity of 41 was etched with 37% phosphoric acid (Eco-Etch, Ivoclar Vivadent, Liechtenstein) for 20s and then washed and dried. This was followed by placement of a bonding agent (Tetric-N-Bond, Ivoclar Vivadent, Liechtenstein). A thin layer of flowable composite was placed on the base of the access cavity. The interlig fibre was then carefully placed along the labial wall of 41, with half of the fibre within the tooth and the other half emerging from the access cavity (Fig 7). It was then light cured for 30s (Fig 8). Composite (Tetric-N-Ceram, Ivoclar Vivadent, Liechtenstein) build-up was done around the Interlig fibre, followed by tooth preparation for an LS2 crown (Fig 8). Shade selection was done using Vita 3D Master Guide (VITA). The shade was 4M2. Putty impression was made, and the patient was recalled after 4 days for cementation of the LS2 crown.

Cementation of Lithium Disilicate Crown

The crown was evaluated for marginal and interproximal adaptation, confirming a precise fit with no rocking or gaps. The ceramic surface was cleaned with alcohol, followed by etching the intaglio surface with 5% hydrofluoric acid gel (porcelain Etch, Ultradent) for 30 seconds. After etching, the crown was rinsed in water and then dried using an air/water spray. A silane coupling agent (Porcelain Silane, Ultradent) was applied for 60 seconds, and excess was blown off with a strong air stream.

The tooth was etched with 37% phosphoric acid (Eco-Etch, Ivoclar Vivadent, Liechtenstein), rinsed, and gently dried. A universal adhesive (Tetric-N-Bond, Ivoclar Vivadent, Liechtenstein) was then applied to the etched tooth for 20 seconds and light-cured. The crown was cemented using adhesive resin cement, followed by tack-curing for 2s to facilitate removal of excess semi-set cement with a scaler. Finally, each surface was polymerized for a minimum of 20 seconds. After cementation, final evaluation of the fit was confirmed (Fig 9,10).

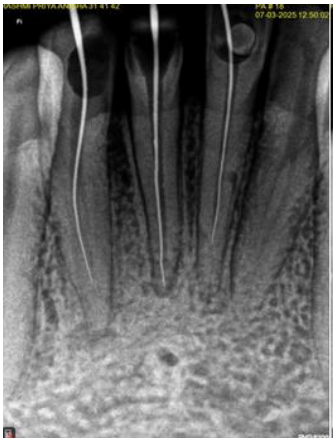
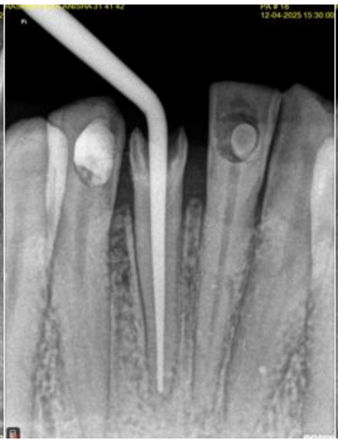


Fig 2. WL determination-41 Fig 3. Master cone- 41 Fig 4. WL determination- 31

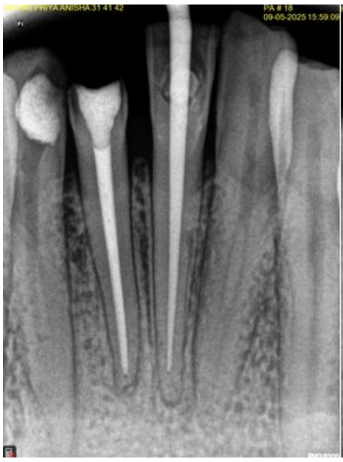


Fig 5. Master cone radiograph- 31 Fig 6. Obturation radiograph - 31, 41


Fig 7. Placement of Interlig fibres on 41 Fig 8. Tooth preparation on 41

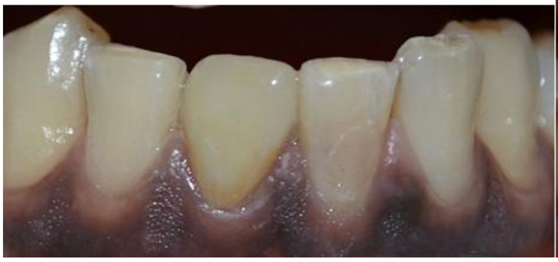


Fig 9. Post cementation of LS2 crown on 41 Fig 10. Lingual view

IV. Discussion

When anterior teeth lose structural integrity, timely treatment is essential to regain aesthetics, chewing ability, and strength. Fiber-reinforced composite materials offer an advanced and optimal restorative approach for cases ranging from minor to severe fractures [9]. Permanent teeth endure significant mechanical stresses during normal function, with biting forces reaching up to 90 kgf and chewing forces ranging between 7-15 kgf. To ensure long-term clinical success, dental restorations must demonstrate sufficient resistance to these functional loads, particularly shear forces in anterior teeth. This requirement necessitates that direct fibre-reinforced composite restorations closely mimic dentin's mechanical properties while effectively distributing occlusal stresses along the root [10,11].

Interlig consists of braided glass fibre bundles pre-saturated with light-curable composite resin [12]. Its fiber reinforcement system effectively redistributes polymerization shrinkage stresses, enhancing the restoration's load-bearing capacity [12,13]. When adapted to cavity walls, these fibers function similarly to dentin-enamel complex (DEC), creating a harmonious biomechanical relationship between tooth structure and restorative material. The "wallpapering" technique of lining cavity walls with fibers provides exceptional resistance to vertical occlusal forces by dissipating lateral stresses, resulting in minimal and often repairable damage to the tooth-restoration interface [13]. Research by Luthria et al. found glass fiber (Interlig) reinforcement superior to polyethylene fiber (Ribbond) in fracture resistance, citing inadequate resin impregnation as compromising Ribbond's performance [14]. This aligns with Ozel and Soyman's findings of reduced polymerization shrinkage in glass fiber composites [12].

Lithium disilicate ceramics are extensively employed in indirect restorations due to their natural tooth-like aesthetics, excellent optical properties, and compatibility with CAD/CAM fabrication techniques [15]. Clinical studies report excellent survival rates for lithium disilicate crowns (LDC), with 100% at 2 years and 97.8% at 5 years. However, these restorations may experience technical complications, including veneering porcelain fractures, chips, and cracks [16]. A key benefit of lithium disilicate ceramics (LDCs) is their excellent biocompatibility with oral soft tissues. The material’s superior polishability enhances gingival fibroblast and epithelial cell adhesion and growth leading to a favourable periodontal response. Furthermore, clinical studies report minimal to no inflammatory markers in gingival crevicular fluid after the placement of LDC restorations, underscoring their tissue-friendly nature [15]. Hence, LS2 crown is an excellent choice for restoring teeth requiring a full-coverage restoration.

In the present case, the prolonged placement of calcium hydroxide intracanal medicament led to the weakening of the root canal walls. This necessitated the placement of Interlig to allow for the reinforcement and offsetting the vertical stresses. Since the tooth had full coverage PFM crown that dislodged, a new LS2 crown was chosen as the material of choice owing to its excellent aesthetics and biocompatibility.

V. Conclusion

While restoring structurally compromised endodontically treated teeth presents significant clinical challenges, contemporary techniques utilizing resin-impregnated glass fibre reinforcement combined with flowable and bulk-fill composite resins demonstrate superior reinforcement capabilities compared to traditional restorative approaches. This innovative combination has been shown to significantly improve the fracture resistance and longevity of endodontically treated teeth.

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