INTRODUCTION

Dental treatment and techniques have evolved from “extracting the infected tooth” to “treating the infected tooth”. Endodontic therapy has traversed a serpentine course so far. In the current scenario, a grossly decayed tooth having little or no crown structure is effectively used to support a restoration. It thereby restores function and aesthetics, also provides psychological comfort to the patient. Special techniques have to be considered when we need to restore such mutilated teeth in order to attain a good prognosis. [1] With advances in restoration of endodontically treated teeth, post and core system has emerged as an option to build up the lost tooth structure. The post is that part which engages the radicular dentin to achieve retention and the core replaces the coronal portion of the crown. This can be fabricated in metal as one piece – casted restoration or could be a separate post with a core build up. [2]

Core build-up materials are those which are used to repair the damaged tooth structure before the crown preparation is done and stabilize the weakened parts of the tooth. So it can be stated that they are a key part of the preparation for an indirect restoration consisting of a restorative material. [3] Cores provide retention and resistance form for crowns and behave as transitional restorations before crown preparation. [4]

An ideal core build-up material must possess excellent mechanical properties in order to resist the stresses that may be produced during function, providing unbiased stress distributions of forces and decreasing the probability of tensile and compressive failures. [3] Strength is not the only criteria for selection of core material, but it is crucial. Stronger core materials better resist deformation and fracture, provide fair stress distributions, and reduce probability of tensile and compressive failure, leading to greater stability and higher probability of clinical success. If other variables are considered to be equal, the strongest core material is indicated. [5]

The strength of a material can be described by tensile strength, shear strength, flexural strength and compressive strength, each of which is a measure of stress required to fracture a material. In the oral environment shear failure is likely not to occur due to four reasons:

1) many brittle materials in restored tooth surfaces generally have rough curved surfaces
(2) presence of chamfers, bevels, or changes in curvature of a bonded tooth surface would make shear failure of a bonded material highly unlikely to occur.

(3) to produce shear failure, the applied force must be located immediately adjacent to the interface.

(4) tensile strength of brittle materials is usually well below their shear strength values, tensile failure is hence more likely to occur. \[6\]

Compressive strength is considered to be a crucial indicator of success because a high compressive strength is necessary to resist masticatory and para functional forces. Tensile strength is important because dental restorations are exposed to tensile stresses from oblique or transverse loading of their complex geometric forms. \[5\] Flexural strength is considered to be sensitive to surface imperfections such as cracks, voids, and related flaws, which can influence the fracture strength of brittle materials. \[7\]

Amalgam has been used traditionally as a build-up material for more than 150 years now. There are some advantages of dental amalgam as a restorative material such as amalgam being strong in bulk section, it not being technique sensitive and it being sealed by corrosion products. The compressive strength of dental amalgam as per literature is 380 – 540 MPa, which develops progressively after trituration but tensile (57 MPa) and flexural (114 MPa) strengths are much lower, making amalgam brittle. The well-known disadvantages of amalgam such as slow setting process, lack of adhesion to the tooth structure, weak in thin section, mercury content and color, are the reasons why alternative core build-up materials have been developed. \[8\]

Glass Ionomer Cements (GICs) for restorative dentistry were developed by the end of the 1960’s and were first described by Wilson and Kent in 1971. \[9\] Many properties of glass-ionomer cements such as fluoride release, adhesion to tooth structure, ease of placement and biocompatibility made these materials attractive for their use in practice. The main problem in using glass-ionomer as a core material arose from low compressive (150 MPa) and tensile (15 MPa) strengths and the role of water in the setting reaction. In order to improve the physical properties of Glass Ionomer Cements, several modifications were done. One of the major developments in this direction was the addition of silver particles to Glass Ionomer Cement (Miracle Mix) which significantly increases its strength, however in vitro studies showed
opposing results. Glass Ionomer Cement with Resin adheres to both enamel and dentin encouraging clinicians to select such materials in core build up procedures.

Composite resins are clinically proven dental restorative materials that were developed in the beginning of 1960’s. Composite resins were used because of their appearance, convenience of a single visit core placement and preparation, avoiding mercury controversy and strong dentin bond strengths (11–28 MPa). Compared to glass ionomers, composites proved to be superior in respect to their mechanical properties. Composite resins also had some pitfalls such as high technique sensitiveness, difficulties in distinguishing tooth from core during preparation and dentine bond rupture by polymerization contraction.

 Improvements in composites and the development in dentin bonding systems have lead to the development of more conservative techniques, which allow increased opportunities to preserve the badly broken down teeth. Recently core build up materials such as flow composite materials have been introduced. There are, however concerns that the mechanical properties of these materials, which incorporate less filler content, could be reduced to allow flowability since fillers have been reported to improve the mechanical properties of bis-GMA-based dental resin. This suggests that flowable materials with less filler content might be mechanically weaker than their more filled counterparts.

The present in – vitro study is being undertaken to evaluate the compressive strength, tensile strength, and flexural strength of four different direct core build up materials:

- Para Core (ColteneWhaledent, USA)
- Luxacore Z Dual (DMG –Dental Milestones Guaranteed, Germany)
- Fluorocore (Dentsply Caulk, USA)
- Multi Core (IvoclarVivadent)

Para Core is a fiber reinforced, dual cure, and radiopaque core build up material. It exhibits a stackable, non slumpy consistency and is formulated to cut similar to dentin, allowing the bur to move smoothly between natural tooth structure and the material without creating troughs and grooves. It incorporates glass particles that impart high strength. Using Parabond adhesive along
with Paracore provides excellent retention to enamel and dentin providing lasting restoration. Parabond is a composite cured self conditioning adhesive. \[^{[10]}\]

Luxacore Z Dual can be automatically mixed and dispensed with intraoral tips, has ideal flow properties allowing tooth substance, and posts to be totally surrounded, while avoiding gaps or air pockets, and is available in different shades. It has thorough and even distribution of nanoparticles throughout the resin matrix, resulting the virtual elimination of particle agglomeration. With the addition of Zirconium Oxide, the compressive strength and dentin like cutting characteristics of radiopaque Luxacore have been enhanced. It cuts and trims like dentin and is not too hard as many other core or general restorative composites tend to be. \[^{[11]}\]

Fluoro Core composite build up material consists of two components, base plus catalyst which when mixed form dual cured highly filled resin core build up material.

Multi Core composite is a dual curing core build up material consisting of two components –base and catalyst and comes in four shades which provide an optimum foundation for the reconstruction of vital and non-vital teeth with part or most of the clinical crown missing.

These materials are being readily used in the modern day dentistry due to their desired properties which are required for maintaining the longevity of the teeth.