

Resin based core build up materials - A review

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Abstract

A core build up is a restoration placed in a severely damaged tooth in order to restore the structural balance, functional efficiency and aesthetic harmony of the dentition (including oro-facial structures). In order to achieve these criteria, certain factors should be kept into consideration such as: it should protect the remaining tooth from fracture, it should have sufficient compressive strength to resist intra-oral forces, sufficient flexural strength to prevent core dislodgement during function, biocompatibility with the surrounding tissues, ease of manipulation, ability to bond to tooth structure, pins and posts, dimensional stability.

To compensate its drawbacks and to enhance its durability, certain materials have been introduced in order to fulfil most of its criteria. Certain materials such as amalgam, resin based core build up materials, glass ionomer cements and others have been introduced.

These resin based core build up materials met most of its demands which is required in order to fulfil its criteria for an ideal core build up materials. Most of the resin based core build-up materials placed in increments in order to cure completely but now a days few of its materials can be placed in bulk such as Bulk Flow materials and some materials releases fluoride such as Fluorocore, Absolute dentin core build up composite, Pulpdent Hardcore.

Therefore the review of this literature could be a helpful for dentists to use these new promising restorative materials with long term clinical outcome.

Keywords: Microhardness, Flowcore, Biocompatibility.

Introduction

A core build up is a restoration placed in a severely damaged tooth in order to restore the structural balance, functional efficiency and aesthetic harmony of the dentition (including oro-facial structures).¹ An ideal core build up material should have physical properties similar to those of tooth structure as a restored tooth tends to transfer stress differently than an intact tooth, where the occlusal biting loads are transferred to dentin as compression that is distributed over a large internal volume of tooth structure reducing local stress.² In order to achieve these criteria, certain factors should be kept into consideration such as: it should protect the remaining tooth from fracture, it should have sufficient compressive strength to resist intra-oral forces, sufficient flexural strength to prevent core dislodgement during function, biocompatibility with the surrounding tissues, ease of manipulation, ability to bond to tooth structure, pins and posts, dimensional stability.

To compensate its drawbacks and to enhance its durability, certain materials have been introduced in order to fulfil most of its criteria. Certain materials such as amalgam, resin based core build up materials, glass ionomer cements and others have been introduced.³ But now a days, resin based core build up materials proved to be more demanding because of its high efficiency and low drawbacks. Resin composites offer various advantages including high strength, fluoride release, ease of manipulation and also enhance the ability to reproduce the shade and translucency

of natural teeth. However, microleakage may occur and the ability of composites to absorb moisture makes their dimensional stability unsatisfactory.^{4,5}

These resin based core build up materials met most of its demands which is required in order to fulfil its criteria for an ideal core build up materials. Most of the resin based core build-up materials placed in increments in order to cure completely but now a days few of its materials can be placed in bulk such as Bulk Flow materials and some materials releases fluoride such as Fluorocore, Absolute dentin core build up composite, Pulpdent Hardcore. Some of them are cured and bonded in an integrated form i.e., post, tooth and core together.

Most of the resin based core build up materials are hydrophobic such as Filtek Silorane restoration and to overcome its effect Spee dee build up material introduced in the market which is favourable in the moist oral conditions. Most of the materials can be cured upto 2mm depth but Clearfil Photocore completely cures upto a depth of 9 mm which is a unique property. Since resin based core build up materials completely depends on the curing factors, therefore, Bright Flowcore is specially designed for areas where light is difficult to reach as it ensures polymerisation in all parts due to its dual curing properties. Since, most of the materials are meant for core build up materials but Bright flowcore can be used both as core build up materials and post cementation. These resin based core build up materials can be placed both in vital and non-vital teeth.

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Therefore, different resin based core build up materials introduced in the market and thereby its recent developed techniques counteract few drawbacks of its previously introduced materials.

There are many factors which affect the strength of the core materials such as filler particle size i.e., bigger the filler particle size, more the strength of the core materials; filler loading i.e., more the number of filler particles increases the strength of the core materials and thereby reduces volumetric shrinkage accompanied by lower stress values which leads to high bond strength;⁶ intensity and distance of the incident light i.e., more the intensity and lesser the distance increases the strength of the core materials; increment thickness i.e., it should be 2 mm thick so as to allow light to pass through the composite resin for proper polymerisation (since curing depth and microhardness are inversely related with thickness). An inadequate curing degree affects the chemical and physical properties of the composites such as water absorption, discoloration, wear resistance, strength, elution of the possible irritant, toxicity, hardness, marginal breakdown, bond between the tooth, adhesive and restoration.

In order to minimise these effects, a composite resin should be cured to a high degree and to an appropriate depth as well. The effectiveness of fiber reinforcement Thus, recently developed resin based core build up materials are efficiently effective in most of the cases. The effectiveness of fiber reinforcement is dependent on many variables including the resins used, the quantity of fiber in the resin matrix,^{7,8} length of fibers,⁸ form of fibers,⁹ orientation of fibers,¹⁰ adhesion of fibers to the polymer matrix¹¹ and impregnation of the resin.¹²

Factors affecting the strength of the core materials

1. Filler particle size
 2. Filler loading
 3. Polymerisation initiator concentration
 4. Monomer type
 5. Amount of monomer
 6. Silane coupling agent
 7. Shade and translucency of the material
 8. Intensity and distance of the incident light
 9. Wavelength of the light
 10. Irradiation times: Irradiation time should be 40 seconds which produces greater microhardness values but a further increase in exposure time from 40-60 seconds did not result in significant microhardness improvement.
- Total energy (intensity x exposure time) is important in the depth of cure, it has some disadvantages such as temperature rise and pulpal effects because of the heat.
11. Design and size of the light guide
 12. Increment thickness: It should be 2mm thick so as to allow light to pass through the composite resin for proper polymerisation.

Curing depth and microhardness were inversely related with thickness. Thus, it is recommended to apply composite in the layering technique with 2mm thickness in each layer.

An inadequate curing degree affects the chemical and physical properties of the resin composite such as water absorption, discoloration, wear resistance, strength, elution of the possible irritant, toxicity, hardness, marginal breakdown, bond between the tooth, adhesive and the restoration. In order to minimise these undesirable effects, a composite resin should be cured to a high degree and to an appropriate depth as well.

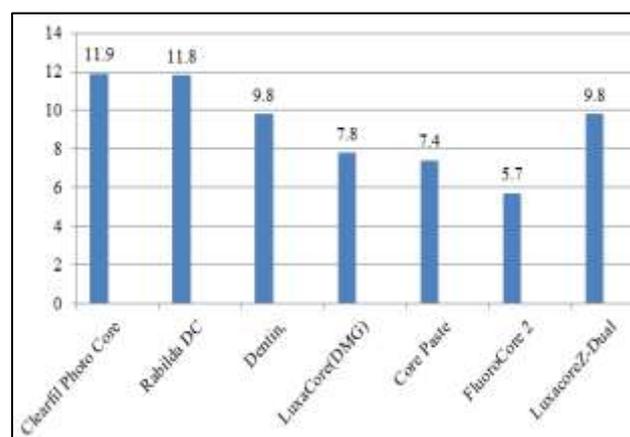


Fig. 1: Cutting characteristics of different resin based core build up materials

Properties

1. Cuts like dentin.
2. Extremely high compressive strength.²¹
3. Excellent flow properties.
4. Reliable curing.
5. One material for build up and cementation.
6. Reliable polymerisation: No layering required.
7. Prevents particle agglomeration
8. Better handling characteristics



Fig. 2: Multicore Flow; Clearfil Photocore

Table 1: Comparison of core build-up materials, their compositions and bonding agents²⁶⁻²⁸

Material	Type	Composition			Bonding agent
Tetric N-Ceram	Nano-hybrid resin composite	Urethane dimethacrylate, ethoxylated Bis-EMA, Bis-GMA(18.8wt%), Barium glass filler, Ytterbium trifluoride, Mixed oxide(63.5wt%), Polymer(17wt%), Additives, Catalysts, Stabilisers and Pigments(0.7wt%)			Tetric n-Bond
Clearfil Photocore	Light cured Core build-up Hybrid Composite	Silinated silica filler, Silinated barium glass filler, triethylene glycol dimethacrylate, bisphenol-A diglycidylmethacrylate(Bis-GMA), dicamphoroquinone, catalysts, accelerators and other filler contents			Clearfil SE Bond
MultiCore Flow	Self-cured core build-up composite with light cured option	Wt% Bis-GMA, Urethane dimethacrylate, Triethylene glycol dimethacrylate, Barium glass fillers, Ba-Al-fluorosilicate glass, highly dispersed silicon dioxide, Ytterbium trifluoride, Catalysts, Stabilisers, Pigments	Base 28.1	Catalyst 28.4	Adhe SE
			54.9	54.4	
			16.4	16.2	
			0.6	1	
LuxaCore Z-Dual Automix	Dual -cured core build-up composite	Bis-GMA based dental resins (28%), inorganic filler (70%), additives, pigments, catalysts (2%)			Luxabond

Conclusion

Various resin based core build up materials are comparable in number of ways as Luxacore has high compressive strength and flow properties whereas Tetri Evo Ceram doesn't have good flowability. Bright flowcore can be used even in poor accessible areas where light is difficult to reach. Fluorocore 2 has high compressive strength, tensile strength and flexural strength whereas Rock core has least flexural toughness. Spee Dee behaves favourably in moist oral conditions whereas other materials are hydrophobic in nature where chemical reaction is inhibited in the presence of moisture.

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None.

Conflict of Interest

None.

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