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RESEARCH ARTICLE

BONDABLE FIBRE REINFORCEMENT IN PEDIATRIC DENTISTRY

***Dr. Mansi Semwal, Dr. Shweta Chaudhary, Dr. Rohan Shah and Dr. Sneha Desai**

Department of Pediatrics and Preventive Dentistry, Bharati Vidyapeeth Deemed University Dental College and Hospital, Pune

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ABSTRACT

Fibre is a bondable, biocompatible, esthetic material. By virtue of its wide spectrum of intended properties, it enjoys various applications in clinical dentistry. Different clinical applications include space maintainers, fixed partial dentures with a natural tooth pontic, endodontic posts and cores and splint materials in children. Fibres can be used as an alternative to conventional treatment in pediatric dentistry.

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INTRODUCTION

There is an old saying "Health is harmony disease discord". This saying lays the foundation on which beauty rests. Hence a healthy oral cavity is the primary requisite for beautiful looks. Of all the structures in the human body, the oral cavity is the most sensitive biological indicator. Provision of Innovative treatment solutions to various problems has always been the motto of medical scientific brains.

"Dentistry is no exception to this Endeavor."

Fibre reinforcement is one such achievement in the field of dental technology which has been accomplished by inspiration from the nature. The use of fibre reinforced composites / ribbons has become a day to day practice in dental set up which has made life easier for the dentist at the same time helping them provide quality care to the patient (Ganesh, 2006). Despite the fact that it is preventable, Dental caries is the most common chronic disease of childhood. Caries in very young children, known as early childhood caries, may be defined as at least one carious lesion affecting a maxillary anterior tooth in a pre –school-age child. Until very recently, the only treatment option for early childhood caries was extraction of the affected primary anterior tooth, when there was severe coronal destruction.

Corresponding author:* **Mansi Semwal,
Department of Pediatrics and Preventive Dentistry, Bharati Vidyapeeth Deemed University Dental College and Hospital, Pune

Premature loss may lead to loss of esthetics, speech impairment & development of oral habits. In recent years, various types of fibre reinforcements have come into widespread use as an alternative to cast or prefabricated metal posts in the restoration of endodontically treated teeth (Sule Bayrak, 2009). In the mid 1990's researchers began to experiment with different types of fibres as a method of improving the fracture strength of provisional restorations. Fibre materials are categorized by fibre type, orientation and whether the resin impregnation of the fibre is performed by the dentist/laboratory technician or by the manufacture. Fibre material included the use of carbon, aramid (kevlar), polyethylene, and glass fibres. Fibre orientation includes unidirectional patterns, where all of the fibres run in parallel, braided and woven patterns. Glass fibres can also be manufactured with or without resin applied to the glass fibres. When manufactured with resin applied, the fibres are said to be impregnated. The most commonly used fibres reinforcement in today's dental application are carbon, polyethylene and glass fibers (David Dindal, 2004).

Classification

In the early 1990s, several different types of Fibre reinforcement materials were introduced.

- Kevlar.
- Carbon
- Glass

- Ultra – high- molecular – weight polyethylene (UHMWPE).
- Silane treated glass.

Currently, the most popular fibre types are Ultra high molecular weight polyethylene fibre (UHMWPE) & Glass fibre (Howard, 2008).

Uhmpwe fibre in pediatric dentistry

These fibres, introduced to the market in 1992, are bondable reinforced fibres consisting of ultrahigh-strength polyethylene fibres. These fibres far exceed the breaking point of fibre glass and are so tough that specially made scissors are required to cut them. Unlike Kevlar, these fibres absorb less moisture than the dental resins. The key to these fibres success and what distinguishes them from the other fibre reinforcements is there patented leno weave designed with a lock-stitch feature that effectively transfers forces throughout the weave without stress transfer back into the resin, weave also provides excellent manageability characteristics having virtually no memory, These fibres adapts to the contours of the teeth and dental arch and bonds to any composite system. Fibres easily absorb water because of the "gas-plasma" treatment to which they are exposed. This treatment reduces the fibres' superficial tension, ensuring a good chemical bond to composite materials. It is biocompatible, esthetic, translucent, practically colorless and disappears within the composite or acrylic without show-through (Mouradian, 2001 and Milnes, 1996).

Applications in Pediatric Dentistry

Endodontic post and core

The early loss of primary anterior teeth may result in reduced masticatory action, loss of vertical dimension, initiation of parafunctional habits (tongue thrusting, speech problems), esthetic functional problems such as malocclusion and space loss, and psychological problems that can interfere in the personality and behaviour of the child . Restorative treatment options are pre-fabricated crown and biological and resin composite restoration either by means of direct or indirect techniques. Polyethylene fibres were recently introduced and can be used as an intra-canal retainer associated with the resin composite as an alternative option for reconstruction of primary incisors severely damaged by an extensive carious lesion. A recent approach dictates the use of composite alone or in combination with other reinforcement material. In recent years, various types of fibre reinforcements have come into use as an alternative to a cast or prefabricated metal post in restoration of endodontically treated teeth. Use of posts and cores enables more extensive reconstruction of grossly decayed and destructed anterior primary teeth (Viera, 2001; Motisuki, 2005). Various types of space maintainers can be used to avoid malocclusion as a result of premature loss of primary teeth. Polyethylene fibre-reinforced composite used as a fixed space maintainer offers many advantages. FRC has an esthetic appearance, is easily manipulated, can be quickly inserted in a single-visit procedure that requires no laboratory services, poses no risk of damage to abutment teeth and is easy to clean (Qudeimat, 1998).

Splint

Splinting teeth for periodontal, orthodontic, or posttraumatic reasons is a common procedure. Although traditional methods are successful, splinting teeth with reinforcement fibres that can be embedded in composites has gained popularity. It is a biocompatible, esthetic material made from a high-strength polyethylene fibre. The various advantages of this material include ease of adaptation to dental contours and ease of manipulation during the bonding process. Because it is a relatively easy and fast technique, procedures can often be completed in a single appointment. It also has acceptable strength because of good integration of fibres with the composite resin; this leads to good clinical longevity. Because a thinner composite resin is used, the volume of the retention appliance can be minimized. In addition, in case of fracture during wear, the appliance can be easily repaired. There is no need for removal of significant tooth structure, making the technique reversible and conservative. It also meets the patients' esthetic expectations. Tooth mobility has been described as an important clinical parameter in predicting prognosis for this reason and for patient comfort, splinting has been the recommended therapy to stabilize teeth. In the past, direct stabilization and splinting of teeth using an adhesive technique required the use of wires, pins, or mesh grids. These materials could only mechanically lock around the resin restorative. Because of this, there was the potential of creating shear planes and stress concentrations that would lead to fracture of the composite and premature failure. When the splint failed, the clinical problems that occurred included traumatic occlusion, progression of periodontal disease, and recurrent caries (Wheeler, 1994; Karaman, 2002).

Fixed partial denture

With the increasing application of fibre-reinforced composites in dentistry, these materials also gain popularity in prosthetic applications. The development of FRC offers new possibilities in minimally invasive treatment approaches. Furthermore, FRC resin restorations have the advantages of good aesthetics, translucency, ease of repair, and an ability to bond to the abutment teeth, thereby compensating for less-than optimal abutment tooth retention and resistance form. These materials also have the potential for chairside and laboratory fabrication. Different therapeutic options can be considered for the replacement of a congenitally or traumatically missing permanent incisor teeth. Direct and indirect fibre-reinforced resin composite fixed partial dentures are a new way to produce minimally invasive, esthetic, and cost-effective metal free tooth replacement. These treatment alternatives have a number of applications, such as chairside tooth replacements, long-term provisionals, fixed partial dentures, and economically feasible tooth replacements, for patients who cannot afford more traditional treatment regimens. As an alternative to the traditional restorations in anterior single-tooth deficiency, fiber-reinforced adhesive bridges, which are a more preventive, time saving and economical method, have been produced.

Congenitally missing teeth and conical lateral incisor teeth particularly seen on the anterior region in adolescences are an esthetically and functionally challenging situation for the clinician and the patient. As far as the relatively young ages of these patients are concerned, the restoration should be applied with a minimally invasive approach. Fibre-reinforced composite resin applications, which have recently become increasingly popular, can be considered as the treatment of choice in these cases, as they offer a minimally invasive fixed treatment option. The loss of maxillary incisors in childhood

has always been problematic, requiring immediate attention to restore both esthetics and function. FRC prosthesis can be used for fixed tooth replacement following traumatic tooth loss in pediatric and adolescent patients. It is a more conservative treatment option than conventional fixed partial dentures and can be more cost-effective than other types of metal-free tooth replacements. A preliminary retrospective clinical study by Piovesan et al. suggested that polyethylene FRC fixed partial dentures (FPDs) could be a functional and esthetic alternative to replace a lost tooth (Piovesan, 2006 and Unlu, 2006).

Conclusion

Fibre reinforced composites are slowly but surely getting incorporated in all aspects of dentistry due to their cost, being light weight, having moisture resistance, chemical resiisatnce, acceptable thermal and chemical properties and high strength. With continuous further advancements into its properties, FRCs hold great promise for the future of Pedodontics.

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