Mouth and Teeth

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Use of semi-interpenetrating polymer network in fiber-reinforced dental composites

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Over the time, composite resins have evolved from bisphenol A glycidyl methacrylate (*bis*-GMA) monomer developed by Bowen in 1962 to fiber-reinforced composite (FRC) substructures. The 54 years of endless refinement along this path has virtually changed the original composition of this extraordinary material [1]. Over the years, many studies such as changing the matrix, filler type, size and shape, have been conducted to improve the mechanical properties of the dental composite materials [2].

With the development of FRC, a new era of metal-free, adhesive and esthetic dentistry has been introduced [3]. The key factors that influence the physical properties of FRC are fiber loading in a matrix system, fiber orientation, fiber position and above all efficacy of the bond at the fiber-matrix interface [4]. However, if the reinforced polymer does not wet the surface of every fiber present in FRC, the physical and mechanical properties such as solubility, sorption, modulus and flexural strength are affected due to voids [5, 6].

The recent advent of FRC material having silanted glass fibres impregnated with an interpenetrating polymer network (IPN) resin matrix has gained investigators' interest. In IPN, or more precisely semi-IPN matrix, linear and cross-linked polymers phases are not chemically bonded together [7]. The key and decisive property of semi-IPN is independency of polymeric network [8]. The linear and cross-linked polymer networks coexist in the same volume of the space [9, 10]. In short, their bonding to composite resin and to adhesives/composite cements rely on interdiffusion bonding mechanism [11, 12]. On the surface of FRC with semi-IPN, the enriched layer of linear polymer phase is present [11].

The IPN bonding mechanism is already established in repairing the denture and bonding of acrylic teeth to the denture base polymers [13]. However, their use in FRC is recent. Development of the FRC with new types of resins systems can led to the use of FRCs in a variety of dental disciplines. It is envisaged that if a suitable adhesive resin is allowed to diffuse into linear polymer phase on the surface of the FRC, the final quality of FRC might be improved further, and desirable mechanical and physical properties might be achieved.

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