OBTURATING MATERIALS : ALTERNATIVES TO CONVENTIONAL GUTTAPERCHA

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ABSTRACT

Gutta-percha has been used in endodontics as the main core obturating material since a long time. But still it does not fulfill all the requirements of an ideal obturating material. The quest to find alternatives to gutta-percha has lead to the development of materials such as Resilon and other modifications of conventional gutta-percha. These newer materials have helped to introduce the concept of adhesion and creation of monoblocks to the world of root canals. This paper provides a review of the materials that might replace gutta-percha in the future.

KEY WORDS

Monoblocks, Resilon-Epiphany, EndoREZ-RGPC, ActiV GP

INTRODUCTION

Complete three-dimensional obturation of the root canal system with an impervious, biocompatible and dimensionally stable filling material is an important factor in achieving endodontic success.[1] Inability to completely obliterate the irregularities of root space with the filling material and adequately seal the apical foramen accounts for nearly 60% of root canal failure.[2]

The traditional method of obturation of the root canal system uses a core material in combination with a root canal sealer. In the past numerous materials have used to fill the root canal - Amalgam, Asbestos, Balsam, Bamboo, Cement, Copper, Gold Foil, Iron, Lead, Oxy-Chloride of Zinc, Paraffin, Pastes, Plaster of Paris, Resin, Rubber, Silverpoints, Tin foil etc., but none of them met the requirements of an ideal obturating material. The searches lead to the discovery of "Gutta-percha" as a suitable root canal filling material.

Gutta-percha is a dried coagulated extract of plants of Palaquium, Blanco genus of Sapotaceae family[3]. Being a Trans- isomer of polyisoprene, it has a number of similarities to natural rubber but a difference in form makes its mechanical properties to behave more like crystalline polymers.

Since its introduction as a root filling material by Hill in 1847, gutta-percha has been used extensively in endodontics till today. But the question still remains does it fulfills all the requirements of an ideal obturating material?

It is well established that the success rate in endodontic therapy is lower in teeth filled immediately after positive cultures compared with those filled after a negative culture[4]. This indicates the inability of gutta-percha to entomb remaining bacteria or in other words gutta-percha does not possess adequate anitmicrobial activity.

Also coronal leakage studies clearly indicate that the gutta-percha filling does not seal the canal adequately[5-7]. It would not be wrong to say that gutta-percha is the weak point in endodontic therapy.[6-8]

The aim of this article is to bring light to the newer alternatives to gutta-percha and its modifications that can be used as an ideal root canal obturating material. The materials that will be discussed in this article are primarily based on the concept of adhesion to the root canal dentin that result in formation of monoblocks.

RESILON EPIPHANY SYSTEM (Fig.1)

A new material, Resilon (RealSeal, SybronEndo, Orange, CA; Epiphany, Pentron Clinical Technologies, Wallingford, CT) has been developed to replace gutta-percha and traditional sealers for root canal obturation.

This system is composed of the following:

1. **Resilon Primer:** a self-etch primer that contains sulfonic acidterminated functional monomer, HEMA, water and a polymerization initiator.
2. **Resilon sealer:** a dual-curing, resin-based composite sealer. The resin matrix is composed of BisGMA, ethoxylated BisGMA, UDMA and hydrophilic difunctional methacrylates. It contains fillers of calcium hydroxide, barium sulfate, barium glass and silica. The total filler content is approximately 70% by weight.
3. **Resilon core material:** a thermoplastic synthetic polymerbased (polyester) root canal core material that contains bioactive glass, bismuth oxychloride and barium sulfate. The filler content is approximately 65% by weight. The Resilon core materials, similar to gutta-percha cones, are available in tapers of 0.02, 0.04 and 0.06 and in accessory sizes.

Additionally, pellets of this material are available for use with the Obtura II delivery system (Obtura/Spartan, Fenton, MS).[9]

The resin sealer attaches to the resilon, as well as to the bonding agent used to penetrate into the dentin tubules, forming what can be called a "monoblock": filling materialresin sealerbonding agentdentin.

Obturation with Resilon-epiphany system offers advantages over conventional gutta-percha sealer combinations in terms of better sealing ability[10-11], increased the fracture resistance of endodontically treated teeth[12] and biocompatibility.[13]

Resilon performs like gutta-percha, has the same handling properties and, for retreatment purposes, may be softened with heat or dissolved with solvents such as chloroform. Infact removal of Resilon was faster than that

of gutta-percha and also resulted in cleaner walls in the apical third.[14-15]

ENDOREZ- RGPC SYSTEM (Fig. 2)

Yet another system to obtain an effective bond between gutta-percha and resin-based sealers uses a new brand of .02, .04 and .06 taper resin-coated gutta-percha cones (RGPC) (Ultradent Products, Inc., South Jordan, UT.)

RGPC contain gutta-percha, zinc oxide, barium sulphate and coloring agents and are entirely coated with a thin layer of polymerized urethane dimethacrylate resin (UDMA).

The resin coating is bonded to the gutta-percha by a complex chemical process in which an isocyanate group from a disocyanate and a hydroxyl group of a hydroxyl-terminated polybutadine first react and bonds to the polyisoprene component of the gutta percha. This process is followed by grafting a hydrophilic methacrylate functional group to another isocyanate group of the disocyanate[16]. The average thickness of the resin coating was found to be 7-10 µm.

The RGPC is recommended to be used in conjunction with the dual cure resin-based sealer EndoRez (Ultradent). EndoRez is a urethane dimethacrylate (UDMA) resin-based sealer that has a filler content of approximately 50% by weight of bismuth oxychloride, calcium lactate pentahydrate and silicon dioxide.

The system provides optimal sealing with a success rate of about 91.3% [17] which is in agreement with previous reports in which conventional sealers and gutta-percha were used. Biocompatibility has also been reported to be comparable to conventional gutta-percha.[18-21]

For retreatment cases, the RGPC may be softened with heat or dissolved with gutta-percha solvents. Also the resin-based sealer can be easily removed from the root canal walls by mechanical instrumentation when necessary[22].

METHOD OF USE

The following is a suggested protocol for the use of these materials:

1. During root canal preparation and after each change of instrument, the smear layer should be removed by irrigation with 2.5% - 5.25% sodium hypochlorite and 17% - 19% EDTA solutions followed by rinsing with saline. At the end of the preparation the canals should be kept flooded with EDTA for an additional 60s and finally washed with copious rinsing of saline. After preparation, the canals should be dried with sterile paper points, taking care to leave the surface moist. This is a critical requirement for optimum bonding.
2. An ISO size master cone corresponding to the size of the last instrument used to shape the canal should be fitted to working length with tug-back and then removed.

   For Resilon, the primer should be applied prior to the sealer with the help of a paper point soaked with it. Excess primer is removed with paper points.

   Sealer is then expressed from the double barrel syringe through an auto-mixing tip, and then delivered into the root canal though a 30-gauge needle or it may be applied with the help of a lentulo spiral. The consistency of the Epiphany sealer can be adjusted using the thinning resin.

   The needle is introduced into the canal to within 3-4mm from the working length and the canal space is then backfilled until it reaches the coronal third. The pre-fitted cone should be generously coated with sealer and then firmly inserted to its predetermined length. Cold or warm lateral/vertical condensation along with multiple accessory cones, coated with the sealer, is then used.
3. Excess cones and sealer should be severed at the level of the canal orifice and the coronal part of the obturation should be immediately light-cured with a blue light unit at an appropriate power intensity for 40 seconds. This provides an immediate coronal seal of about 2-3 mm and the rest of the sealer sets in 30-45 minutes.
4. After light-curing of the coronal portion of the root canal filling material, placement of a temporary or permanent restoration should be completed immediately.

ActiV GP SYSTEM

Marketed as a monoblock system, it uses conventional gutta-percha cones that are surface coated with glass-ionomer fillers[23]. This results in stiffer gutta-percha cones, and the presence of the glass-ionomer fillers allows it to be bonded to the root dentin via a glass ionomer sealer. Not much has been reported about the efficacy of this obturation system, but it does provide apical seals comparable to that of gutta-percha and AH Plus sealer.[24]

Tay and Pashley[25] have classified monoblocks as primary, secondary and tertiary depending on the number of interfaces between the root canal filling and root dentin. They classified the Resilon system as a secondary monoblock and the EndoREZ-RGPC system and the ActiV GP system as tertiary monoblocks. Further research is still required to establish whether the monoblock concept actually reinforces the endodontically treated tooth or not.

CONCLUSION

It can be concluded that the concept adhesion has finally reached to the level of [illegible] canals that might provide better success rates. [illegible] clinician now has materials that appear to be a positive alternative to replace the traditional gutta-percha fillings. Still further research is necessary to ascertain the clinical efficacy of these systems.

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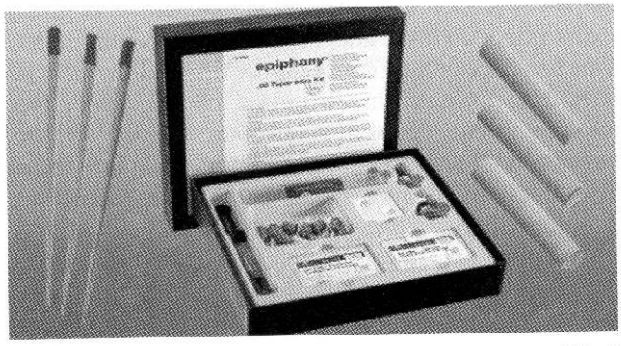
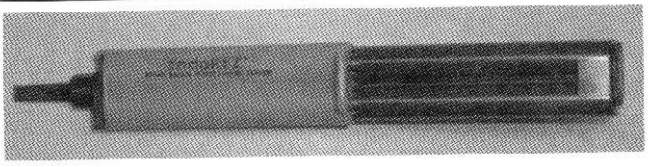


Fig 1. Epiphany System



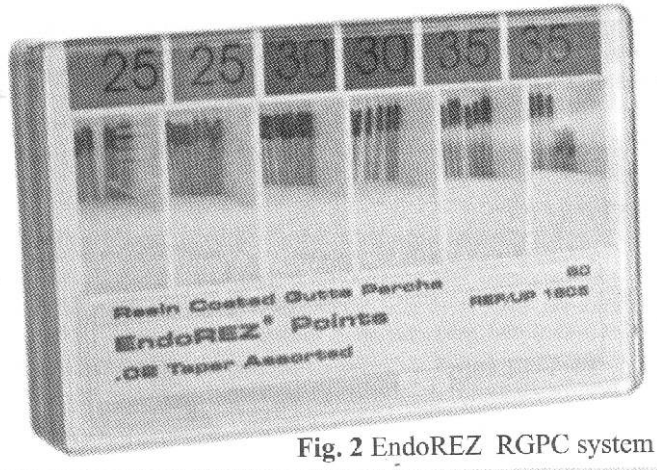


Fig. 2 EndoREZ RGPC system

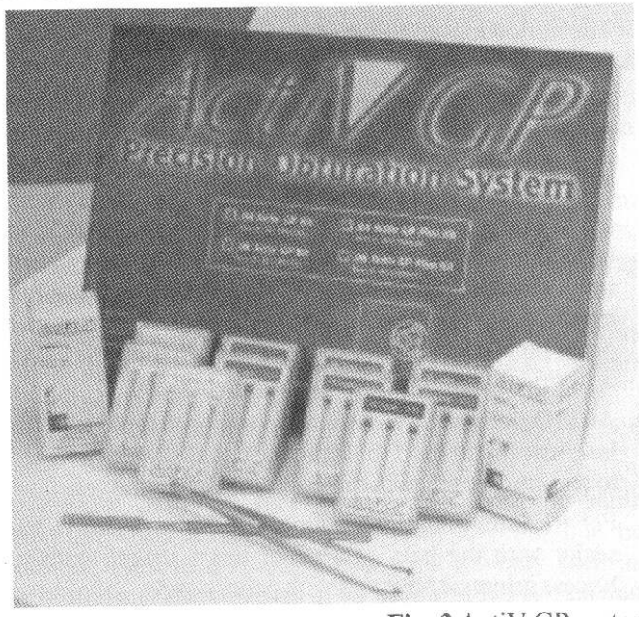


Fig. 3 ActiV GP system