

## Resilon-Epiphany Obturation System

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### Abstract

For over hundred years Gutta Percha (GP) has been the most common material used for the obturation of the root canal. GP was the standard with which newer materials were tested. GP fulfills all the characteristics of an ideal root canal filling material, but has a disadvantage of not being able to seal the root canal on its own and requires a sealer for providing an effective seal. In an attempt to overcome this draw back a new root canal filling material was introduced, called, Resilon which is a thermoplastic synthetic polymer-based root canal filling material and Epiphany being the sealer. This material has the ability of forming a Monoblock with the root canal. The properties of this material has been studied, it has shown promising results and has emerged as a alternative to GP.

**Key Words:** Root Canal, Obturation, Resilon, Epiphany, Monoblock.

### Introduction

Obturation is an important step during root canal treatment, which aids in the periapical healing and prevents further spread of disease. The root canal filling material fulfills this by reducing microleakage and sealing off any inflammatory irritants. The effectiveness of a material to adequately seal the root canal space is established by its physical properties and handling characteristics.

Gutta-Percha has been the choice of root canal filling material for over hundred years, as it possesses many favorable properties, which includes biological compatibility, dimensional stability, pliability, easy placement and removal and radiopacity<sup>1</sup>. GP has universally been accepted as the gold standard for root canal filling material, but it does have one of its disadvantages, of not being able to adhere to the walls of the root canal and requires a sealer for obtaining an effective seal. The poor sealing ability of GP could be one of the causes for the failure of root canal treatment. There has been a quest for an alternative root canal obturating materials, which could bond to the walls of the root canal and provide an effective seal against microleakage. Thus in the early 2000s a resin based thermoplastic root canal filling material based on a biodegradable synthetic polyester, called Polycaprolactone, was marketed as Resilon, to be used in conjunction with its sealer called Epiphany, both by Pentron Clinical Technologies, Wallingford

[CT] US), called the Resilon-Epiphany System (RES) was developed, which claimed to overcome the limitations of GP. This material was developed in an attempt to create an adhesive bond between the solid core material and the sealer thus reducing microleakage<sup>2,3</sup>.

### Composition

Resilon (Resilon Research LLC, Madison CT) consists of polyester, difunctional methacrylate resin, bioactive glass and radiopaque fillers of bismuth oxychloride and barium sulfate, these fillers constitute approximately 65% of the composition. This Resilon is the core material, which according to the manufacturer is very similar to GP. The Resilon performed, handled and looked like GP cones. Standardized non standardized accessory Resilon points and pellets, are available for use with Obtura II (Obtura/Spartan, Fenton [MO], US) injectable system. Resilon can be used with cold or warm obturation techniques and softened by solvent like chloroform and is radiopaque.

A Sealer system is supplied along with Resilon called Epiphany. It consists of a primer and a low viscosity resin composite. The Epiphany primer is an aqueous self-etching primer contains 2-hydroxyethylmethacrylate (HEMA), a sulfonic acid-terminated functional monomer, and a polymerization initiator. The Epiphany root canal sealer, is a dual-cured, low viscosity resin composite consisting of a mixture of bisphenol A-diglycidyl dimethacrylate (Bis-GMA), ethoxylated Bis-GMA, urethane dimethacrylate (UDMA), hydrophilic difunctional methacrylates, and filler particles which is a mixture of calcium hydroxide, barium sulfate, barium glass and silica. Fillers constituted more than 50% of the material by weight<sup>3</sup>. The material can be cured coronally for 40 seconds, using a curing light and is capable of providing an immediate seal at the canal orifice, so as to achieve on-demand curing. If not light activated,

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this resin sealer self-cured in approximately 30 to 60 minutes<sup>2,3</sup>.

Commercial sealers available for Resilon are methacrylate based. Examples include Epiphany (Pentron Clinical Technologies, Wallingford [CT] US), RealSeal (Sybron-Endo, Orange [CA], US), SimpliFill (Lightspeed, San Antonio [TX], US), InnoEndo (Heraeus-Kulzer, Armonk [NY] US).

### Technique of Obturation

- a. Following cleaning and shaping procedure of the root canal an appropriate size master is selected, verified by the visual, tactile and radiographic method.
- b. Choice of irrigant during the procedure would be Sodium Hypochlorite (NaOCl). It should not be the last rinse as NaOCl interferes with the bonding of the resin sealer to the dentin and results in decreased bond strength<sup>9</sup>.
- c. Use of 17% Ethylene di-amine Tetra Acetic acid (EDTA), followed by sterile water or 0.2% Chlorhexidine gluconate (CHX) should be used as the final irrigant.
- d. After blot drying the root canal with sterile absorbent points, the self etch primer is used to condition the root canal walls and prepare them for bonding to the resin sealant.
- e. Two or three drops of the primer are placed in the canal using a pipette, a syringe or a sterile absorbent point.
- f. The excess primer is removed with the help of a dry sterile absorbent point.
- g. The resin sealer is dispensed onto a mixing slab and the viscosity is adjusted using the thinning resin.
- h. The sealer is applied using a sterile absorbent point, Resilon point or lentulo spiral.
- i. The root canal is then obturated using lateral compaction, warm vertical compaction or thermoplastic injection method.
- j. The coronal surface of the material is light cured for 40 seconds<sup>2,3</sup>.

### Properties

**Monoblock Formation:** Monoblock means a single unit. The clinical advantage of using adhesive endodontic sealer with bondable polymeric root canal filling material Resilon-Epiphany is that they bond through out the length of the root canal. By creating micromechanical retention via the formation of a thin hybrid layer to the self etching primer-treated root dentin and chemical coupling to the urethane dimethacrylate containing Resilon root filling material to the methacrylate based sealer, a continuum has been achieved, that results in the creation of a "Secondary Monoblock" between root canal filling and the intra radicular dentin, wherein there are two interfaces, one between the sealer and primed dentin and other between the sealer and Resilon<sup>4,5</sup>.

**Sealing Ability:** Historically endodontic leakage research focused mainly on the quality of apical seal of the root canal system. Coronal leakage into the obturated root canal system had not received any attention until the late 1980s. Since then numerous dyes, bacterial penetration and fluid filtration leakage studies have been evaluated. With the RES, the coronal portion of the obturation is light cured for 40 seconds which creates an immediate coronal seal at the orifice and the rest of the sealer setting in 25 minutes<sup>6</sup>. RES produces a Monoblock and microleakage studies have shown that it has good apical sealing ability<sup>7,8</sup>.

The penetration of root canal filling material into the fins, deltas, accessory and lateral canals and dentinal tubules is a function of viscoelastic property of the delivery system. RES has been shown to flow into all the complex anatomical irregularities. This is aided by the smear layer removal from the root canal during the obturation which allows greater sealer penetration into the exposed dentinal tubules, which also increases the adhesion and seal within the canal space<sup>9,10</sup>.

**Inter-radicular Dentin Bond Strength:** RES having viewed as having intermediate bond strength. The creation of a Mono-block also significantly helps the Inter-radicular dentin bond strength to improve<sup>11</sup>.

**Effect of Irrigant on seal of Resilon-Epiphany system:** During biomechanical preparation NaOCl is one of the irrigating solutions used. The manufacturer's instruction for the Resilon-Epiphany system suggests that NaOCl should not be used as the final irrigant, as it may result in reduced bond strength and as NaOCl is an oxidizing agent it leads to the oxidation of some components of the dentin matrix. Oxygen also has been shown to inhibit the polymerization of resins. Hence after use of NaOCl, the root canal has to be irrigated with 17% EDTA followed by 0.2%CHX and flushed with sterile water or saline<sup>11</sup>.

**Sealer and root canal wall condition:** The hydrophilic characteristics of the Epiphany might improve the penetration of the sealer into moist dentin and dentinal tubules. This might contribute to substantially reduced microleakage. The manufacturer recommends that the root canal walls be kept moist, not dehydrated, to take maximum advantage of the hydrophilic properties of the sealers, thus allowing for resin tag penetration and the formation of a hybrid layer. Before the advent of the methacrylate resin based sealers, root canals had to be dried thoroughly before placement of sealers. Studies conducted to compare the effect of different levels of moisture of root canals, from none to wet, on the coronal seal after filling the root canals, demonstrated that the Resilon-Epiphany system leaked less when root canals were blot dried with paper points<sup>12</sup>.

**Effect of intracanal medicament on the RES:**

Calcium hydroxide is one of the most widely used intra canal medicament in endodontics, to reduce residual microbial flora. The remnants of calcium hydroxide on the walls of the root canal after its removal should not interfere with the obturation and it has been observed that with RES, calcium hydroxide did not adversely affect the apical seal<sup>13</sup>.

**Root End filling material:** RES has the advantage of providing an immediate light cured seal. It has been suggested that RES has the potential as a root end filling material when used in an environment with good hemostasis<sup>14</sup>.

**Setting Time:** Commonly used resin cements have been shown to require an anaerobic environment for setting. The root canal has an anaerobic environment and Resilon sealer can set in an anaerobic environment. Manufacturer's instructions for Resilon do not describe the need for an anaerobic environment<sup>15</sup>.

**Fracture resistance of root obturated with RES:**

Resin based dental material have been proposed as a means to reinforce an endodontically treated teeth, through the use of an adhesive sealer in the root canal system. Single canal teeth obturated with the RES have shown increased resistance to fracture<sup>16</sup>.

**Toxicity:** Toxicity of dental materials can be assessed invitro. Resilon has been found to be biocompatible, but Epiphany was more cytotoxic than conventional materials<sup>17</sup> and another study indicating that the cytotoxicity of freshly mixed Epiphany sealer and thinning resin did not exceed that of freshly mixed AH-Plus, an epoxy resin based root canal sealer<sup>18</sup>.

**Retreatment:** In case of retreatment, Resilon obturation can be removed from the root canal by use of heat, solvents and rotary instruments. Resilon can be removed with the use of resin solvent Endosolv-R (Septodont, Paris, France), which contains Formamide and 2-Phenylethanol in the range of 50-100% and 25-50% respectively<sup>19</sup>.

**Summary**

Resilon-Epiphany obturation system is a viable alternative to GP, which has shown to produce a Monoblock, thereby enhancing the coronal and apical seal and strengthening the root. The weak link in the Resilon filled root canal lies at the sealer-dentin interface. Studies have raised doubts about the formation of a Monoblock within the root canal system. Prevention of leakage has not been demonstrated consistently. At best its performance appeared similar to the use of GP and sealer.

Future investigations may focus on the impact of heat on its constituents, performance of Resilon Epiphany sealer, their setting time and degree of polymerization, as well the periradicular response to extruded material.

**Conclusion**

RES was introduced as a challenging material for replacement of GP. As an obturating material it has shown superior characteristics. GP has been studied for all its properties, for over 100 years and it has also been compared with other materials which were introduced as obturating materials and recently with RES. Studies have shown conflicting findings in terms of Monoblock formation, sealing ability, bond strength of the RES. Further research is required to study the properties of RES in detail.

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