

CHAPTER ONE
INTRODUCTION

Advances in adhesive dentistry have made great contributions to cosmetic and restorative dentistry over the past few decades. However, very little research has been performed in applying the principle of adhesive dentistry to the specialty of endodontics (Teixeira et al., 2004a).

Complete obturation of the root canal system with filling material and creation of a hermetic apical seal are the goals of endodontic treatment (Nguyen et al., 1991). Studies have revealed incomplete obliteration of the root canal space to be a major cause of endodontic failure (Dow and Ingle, 1955; Ingle et al., 1994a). It has been shown that approximately 59% of endodontic failures are due to inadequate obturation of the root canal system (Ingle et al., 1994a). Therefore, an effective endodontic obturation must provide a complete three-dimensional filling of the root canal and of all accessory canals (Schilder, 1967). However, the complete sealing of the root canal seems difficult to achieve when using a combination of gutta-percha and sealer that is generally used clinically (Zidan and ElDeeb, 1985; Leonard et al., 1996). Overextension of root canal fillings have been documented to decrease the rate of endodontic success (Seltzer et al., 1963; Storms, 1968). Therefore, the presence of overextended root canal fillings is undesirable (LaCombe et al., 1988). The obturation materials are cytotoxic when they are in contact with tissues. Sealers invoke a foreign body response and inflammation (Rappaport et al., 1964; Olsson et al., 1981).

Resinous restorative materials have steadily gained popularity and are now accepted both for anterior and posterior teeth (ADA Council of Scientific Affairs, 1998). Improvements in adhesive technology have fostered attempts to reduce apical and coronal leakage by bonding a root-filling material to root canal walls (Teixeira et al., 2004a). The concept of dentine bonding procedures for endodontic treatment has been previously investigated. It was found that resin-based adhesive materials might have the

potential to reduce the degree of microleakage from both apical and coronal directions of the root canal system. Many different materials have been proposed as root canal fillings, but none has replaced gutta-percha, which is universally accepted as the “gold standard” filling material (Shipper et al., 2004b). Bonding agents and resins evaluated in previous studies had problems in working properties, radiopacity and retreatability (Tidmarsh, 1978; Rawlinson, 1989; Leonard et al., 1996; Ahlberg and Tay, 1998; Mannocci et al., 1998; Britto et al., 2002; Imai and Komabayashi, 2003).

In 2003, the Pentron Corporation introduced a synthetic polymer-based soft resin bonded root canal obturation system. The system consists of points of various tapers, pellets, a dual-cure sealer, a thinning resin, and a self-etch primer (Chivian, 2004). This is marketed under different brand names including RealSeal™ (SybronEndo, Orange, USA). Shipper et al. (2004b) evaluated coronal leakage using *Streptococcus mutans* and *Enterococcus faecalis* through gutta-percha versus Resilon™ by two different filling techniques. The results indicated that all of the gutta-percha groups had significantly more leakage and the leakage occurred at a faster rate than when Resilon™ with Epiphany™ sealer was used. These *in vitro* results were confirmed in an *in vivo* investigation by Shipper et al. (2005). A dog model was used to assess and compare the efficacy of gutta-percha and AH-26 sealer versus Resilon™ system in preventing apical periodontitis subsequent to coronal inoculation with oral microorganisms. The results demonstrated that periapical inflammation was observed in 82% of the root canals filled with gutta-percha and AH-26 versus 19% for the Resilon™ system.

Contrary to the above findings, Tay et al. (2005a) examined the ultrastructural quality of the apical seal achieved with Resilon™/Epiphany™ and gutta-percha/AH-Plus™. They found that a complete hermetic apical seal could not be achieved with both root canal filling materials.

There have been several studies that evaluated the quality of various root filling materials utilizing different obturation techniques (Shipper et al., 2004b; Shipper et al., 2005; Tay et al., 2005a). However, to date (2006), no study has been conducted to investigate the distribution of canal area occupied by RealSeal™ core materials, sealer and voids compared to that occupied by gutta-percha, sealer and voids using different obturation techniques. This was chosen as the theme of this study.