Application of Adhesive Root Canal Sealer to Vertical Root Fracture Model

—Evaluation of Adhesive Root Canal Sealer Properties in Vitro—

YUMOTO Yasuhiro, ITO Shuichi*, MORI Mari,
ODACHI Tatsuji*, NAKASHIMA Keisuke, SAITO Takashi*
and FURUCHI Yasushi

Department of Periodontology and Endodontology, Division of Oral and Maxillofacial Rehabilitation,
School of Dentistry, Health Sciences University of Hokkaido
*Department of Operative Dentistry and Endodontology, Division of Oral and Maxillofacial Rehabilitation,
School of Dentistry, Health Sciences University of Hokkaido

Abstract: Root canal treatment plays an essential role in the preservation of decayed teeth. Key requirements for successful root canal treatment are to control corrosion, to adequately remove sources of infection, to prevent root fractures, and to maintain the root canal seal for the long term. Vertical root fracture (VRF) is recognized as a major problem following root canal filling. VRF is found mostly in devitalized teeth and may lead to a rapid breakdown of the periodontal tissue along with the root fracture line, and often results in tooth extraction. One of the procedures for preserving VRF teeth is replantation of the tooth following adhesion of the fractured tooth outside the mouth using adhesive resins. However, risks of this method include fatal damage to the periodontal ligament resulting in tooth ankylosis and a prolonged time for healing. Recently, adhesive root canal sealers have been introduced to the market. Good results have been demonstrated when used for root canal filling, indicating that the materials could be used for VRF teeth.

The aim of this study was to investigate the mechanical properties of adhesive root canal sealers to examine the possibility of using them for the treatment of VRF teeth.

Twenty-four single rooted teeth extracted from patients for various reasons with sound root were used for this study. After root canal preparation using an Ni-Ti rotary file and chemical cleaning, the root canals were filled according to the single cone method using one of the following four combinations: 1) gutta-percha point with sealer, 2) gutta-percha point with Accel primer, deinit activator and Superbond sealer, 3) gutta-percha point with Epiphany® and 4) gutta-percha point with AH Plus®. A novel microtensile test and SEM were used to evaluate the adhesive properties. The sealing capacity was evaluated by a fluid filtration system. The permeability test was also performed between Superbond C & B and Superbond sealer.

The adhesive property and sealing capacity of Superbond sealer were significantly better than those of the other sealers (p<0.05). The permeability of Superbond sealer was also significantly higher (p<0.05). In SEM observations, a hybrid layer approximately 3-4 μm in thickness was observed at the interface between Superbond sealer and dentin.

These findings suggest that Superbond sealer possesses adequate properties for sealing root fracture lines of VRF. Root canal filling of VRF teeth with Superbond sealer may be a useful method in view of its simplicity and long-term clinical success.

Key words: Vertical root fracture, Adhesive root canal sealer, Intra-oral adhesion technique