

CHAPTER 1

Introduction

1.1 Principles and Rationale

The fixed partial denture is one treatment option that is widely used for replacement of a missing tooth or teeth, especially in patients who cannot afford dental implants or who reject removable dentures. The treatment procedure sometimes causes post-operative sensitivity or pulpal inflammation, due to either extensive cutting of tooth structure or the material used to fabricate the prosthesis (1-3). The abutment preparation in fixed prosthodontics procedures using dental burs in an airrotor hand-piece causes more severe pulp reactions than do other operative procedures, because a greater amount of tooth structures are cut and more dentinal tubules are exposed. It has been shown that the pulps of between 15% and 25% of teeth prepared for full coverage crowns become necrotic (1-3). Tooth preparation for such crowns reduces tooth substance more extensively than do those for other types of restoration. Injury to the dental pulp may be caused by many factors, such as heat, if water spray coolant is inadequate, and pressure applied to the dentine, particularly when dentine is removed close to the pulp.

Those prepared teeth need to be covered with provisional restorations during fabrication of the final prosthesis. Temporary cement is used for bonding the provisional prosthesis to the tooth structure during fabrication of the permanent restoration. It prevents leakage of saliva and bacteria from outside into the dentine and the dental pulp, and reduces pulpal injury from tooth preparation. It has been claimed that eugenol in temporary cement reduces pulpal inflammation after tooth preparation, due to its anti-inflammatory activity and its bactericidal and analgesic effects. When used in low concentrations, eugenol is slowly released into the dentine and reduces dentine sensitivity and pulpal inflammation from tooth preparation procedures (4).

Thus, the dental pulp can be repaired and healed when temporary cement which contains eugenol is applied to the exposed dentine surface.

On the other hand, eugenol can irritate the pulp when applied directly on the exposed, thin, remaining dentine. When the dentine thickness is less than 0.5 mm, eugenol is released faster than with thick dentine (4,5). Furthermore, there is concern about the negative effects of eugenol on the polymerization of the resin cement, used for permanent cementation of the final restoration. Eugenol inhibits resin polymerization; as a result, the bond strength of the resin cement is reduced (6). For this reason, most dentists avoid using eugenol-containing temporary cement, when they plan to use resin cement to bond the final restorations; thus the sedative effect of eugenol cannot be expected.

The responses of dental pulp to dental procedures or dental materials can be determined by monitoring pulpal blood flow using a Laser Doppler flow (LDF) meter (7,8). This is a non-invasive technique suitable for monitoring the changes of blood circulation *in vivo*.

No studies have measured the change in pulpal blood flow to determine whether or not there is inflammation from the preparation procedures or the materials used. Pulpal reaction is usually investigated by histological examination, which requires the teeth to be extracted. This study is the first study to monitor the reaction of the pulp after fixed prosthodontic procedures and the effects of two types of temporary cement, using a non-invasive technique, without tooth extraction.

1.2 Purpose of the study

The purpose of this study was to use a laser Doppler flow-meter to determine the effects of two types of temporary cement, eugenol-containing temporary cement and non-eugenol temporary cement, on pulpal blood flow after full crown preparation, and one day and seven days after temporary cementation. In addition, the effects of local anesthesia, tooth preparation and gingival retraction on pulpal blood flow were also investigated.

1.3 Research Hypothesis

1. Pulpal blood flow signals recorded after temporary cementation with eugenol-containing temporary cement and non-eugenol temporary cement are different.
2. Pulpal blood flow signals recorded immediately, one day and seven days after temporary cementation are different.
3. Pulpal blood flow signals recorded before and after administration local anesthesia are different.
4. Pulpal blood flow signals recorded after buccal side preparation and after complete preparation are different.
5. Pulpal blood flow signals recorded before and after gingival retraction are different.

1.4 Research design and procedures

This study was designed to evaluate the pulpal responses at various stages of treatment for fixed partial dentures: after local anesthesia; after tooth preparation; after gingival retraction for final impression; and after cementation the provisional restorations with temporary cements, with or without eugenol, using a laser Doppler flow-meter, which is a non-invasive technique. The experiments were carried out on 18 subjects at the faculty of Dentistry, Chiang Mai University, who needed replacement of a mandibular first molar. Twenty premolars and 20 molars were prepared for the abutments of porcelain-fused-to metal bridges. Pulpal blood flow (PBF) was monitored before and after local anesthesia, after buccal side and complete preparation, after gingival retraction and one day and seven days after temporary cementation.