O-23 Analysis of temperature rise on the root surface during continuous wave of condensation technique

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Ⅰ. Objectives

The warm vertical condensation technique offers a homogeneous and dimensionally stable mass of gutta-percha in obturation. However, this technique has been known to be able to cause harmful effect on the supporting tissues of teeth by excessive heat. So it is very important to minimize thermal injury to the supporting tissue in order to gain a successful endodontic therapy. Accordingly, this study was conducted to determine the temperature range which could be kind to the supporting tissues while the root canal is obturated using continuous wave of condensation technique.

Ⅱ. Materials and Methods

A extracted maxillary central incisor was prepared for thermal measurement as described by Weller et al. The tooth was embedded in a orthodontic resin, sectioned in half buccolingually and then reassembled by the use of nuts and bolts through predrilled alignment holes. After cutting the part of crown portion of the tooth and conventional access opening, working length was then established with #10 K-file to the point 1mm from anatomical root apex and it was 17 mm. The root canal was filled with RC-prep and 5.25% NaOCl and then prepared with GT rotary Ni-Ti file. Five thermocouples were placed at 2 mm increments on one side beginning 1 mm from the anatomical root apex and the other five thermocouples at 2 mm increments on the other side beginning 2 mm from it. Totally 10 thermocouples were placed at 1 mm increments on the root surface beginning 1mm from the anatomical root apex. The two wire leads of each thermocouple were connected to the appropriated 10 channels of Data Logger. For all obturations, a nonstandardized medium size gutta-percha cone and a medium-large Buchanan plugger tip were selected. After drying of root canal with paper point, AH-26 root canal sealer was applied on the wall of the root canal. Baseline temperature was measured on the root surface. The ML size plugger was preheated for 2 seconds and then the real temperature of it was recorded before insertion into the root canal. The root canal was obturated with continuous wave of condensation technique as described by Buchanan. The root surface temperature was recorded and ten obturations were performed at each of the following temperature settings: 150℃, 200℃, 250℃ and 300℃. After completion of the temperature recordings, the dentinal-cementum thickness from the inner wall to the outer surface was measured. The data were analyzed using one-way ANOVA followed by Scheffe′ test and linear regression test.

Ⅲ. Results

1. The position of 8 mm from the anatomical apex showed the highest temperature increase at each temperature settings and it was significantly higher than those of other positions ($p<0.05$). The temperature rise was constantly increased toward coronal portion from apex of the root ($p<0.05$).
2. Though the temperature was set at 150℃, 200℃, 250℃ and 300℃ on the digital display of System B Heatsource, the real temperature of the plugger at the 1 mm point from tip revealed 130.82±2.96℃, 158.00 ±5.26℃, 215.92±6.91℃ and 249.88±3.65℃ respectively. The maximum temperature increase on the root surface was 2.37±0.30℃ at 150℃ setting, 3.11±0.3℃ at 200℃ setting, 3.93±0.28℃ at 250℃ setting and 5.69±0.52℃ at 300℃ setting respectively.

Ⅳ. Conclusions

These results suggest that 150℃, 200℃, 250℃ and 300℃ temperature settings on digital display of System B Heatsource be relatively kind to the supporting tissues of the root when the root canal is obturated using continuous wave of condensation technique.