## p-4 Analysis of Temperature Rise on The surface of Buchanan Plugger with Thermocouple

Jin-Suk Cho*. In-Nam Hwang, Won-Mann Oh

*Department of Conservative Dentistry, College of Dentistry, Chonnam National University*

### Ⅰ. Objectives

It is important to avoid thermal injury in the supporting structures around teeth in order to gain a successful endodontic treatment when obturating the prepared canal with electric heat carriers such as System B Heatsource. System B Heatsource has been known as a efficient device in obturating root canal. The manufacturer has recommended practitioners to set 200℃ on the digital display of it. It is very crucial to see the actual temperature on the surface of Buchanan Plugger attached to System B Heatsource. Accordingly, this study was performed to confirm the actual temperature rise on the surface of Buchanan plugger by evaluating the temperature rise on the surface of it, the peak temperature of pluggers of various size using thermocouple.

### Ⅱ. Materials and Methods

The heat carrier system 'System B Heatsource'(Model 1005, Analytic Technologies, USA) and the Buchanan pluggers of F, FM, M and ML sizes are used for this study. The temperature was set to 200℃ which Dr. Buchanan's "Continuous wave of condensation" technique recommended on digital display and the power level on it was set to 10. The touch mode was used. Five thermocouples were placed in direct contact with the surface of each size of Buchanan's pluggers at 1mm increments from the tip to the 4㎜ length of shank. Each thermocouple was secured with cyanoacrylate adhesive and orthodontic resin block. The two wire leads of each thermocouple were connected to the appropriate channels of Data Logger. This was configured to simultaneously record input from the five thermocouples. The heat control spring was touched for 1, 2, 3, 4 and 5 seconds, and the temperature rise on the surface of the pluggers were measured at 1 sec intervals for more than 5 seconds with an accuracy of 0.01℃. Ten trials was determined for each plugger. The average of temperature rise and standard deviation was calculated for each size of plugger. The data were statistically analyzed by two- way ANOVA to determine their significance

### Ⅲ. Results

1. The position at which the temperature peaked was approximately at 1~2㎜ far from the tip of Buchanan plugger. The temperature was decreased toward the shank from the tip of it ($P<0.01$).
2. When the pluggers were heated over 5 seconds, the peak temperature by time of measurement ranged from 215.25℃ to 151.98℃ in a touch for 1 sec, from 205.04℃ to 160.79℃ in a touch for 2 sec, from 189.69℃ to 152.46℃ in a touch for 3 sec, from 188.39℃ to 155.30℃ in a touch for 4 sec, from 175.16℃ to 149.79℃ in a touch for 5 sec. A touch for 1 sec showed the highest peak temperature, followed by, in descending order, 2 sec, 3 sec, 4 sec. A touch for 5 sec showed the lowest peak temperature.
3. The peak temperature was different for each type of pluggers. The peak temperature was highest in F type and followed by, in descending order, FM type, M type. ML type showed the lowest peak temperature ($p<0.01$).

### Ⅳ. Conclusions

This results suggest that the actual temperature on the surface of the pluggers does not correlate well with the temperature set on digital display. Heat concentrates around the tip. The larger plugger reveals lower temperature rise relatively. Activation of the touch spring for 1 sec shows the highest temperature rise.