

## ***2107 Development of an Electrically Heated Painless Injection System***

[K. KONUMA](#), Y. ISHIGURO, T. KOSUGE, M. OOHASHI, T. MURAYAMA, K. SANO, A. YAMAGUCHI, and M. KONISHI, Nippon Dental University, Niigata, Japan

Objective: Painless treatment is a dream for both dentists and patients. Dentists currently use local anesthetic to alleviate the pain of oral surgery. Unfortunately, the injections can be painful. To reduce the pain many dentists use surface anesthesia, or different styles of injection, such as thin needles. We aim to determine if raising the temperature of the anesthetic solution will decrease the pain experienced by the patient. Method: We performed a clinical trial using 40 healthy volunteers divided into 5 equally sized groups. The 5 groups were injected with anesthetic solutions of varying temperatures: coldest, cold, room temperature, heated, and heated with our new system. The drug used was 2% lidocaine with epinephrine 1ml. Injection pressure was kept constant by using an automated injection with 31G needle. The new heating system we designed was made from carbon fiber and powered by a 9V battery. The heater was attached surrounding the syringe. It heats up to 38C and maintains that temperature. The amount of pain experienced by the volunteers was recorded using a VAS (Visual analog scale), and the Mann Whitney u-test ( $p < 0.05$ ) was used to determine the difference in each group. Results: The VAS results and S.D. for the groups were: coldest 14.1( $\pm 7.4$ )mm, cold 16.1( $\pm 14.4$ )mm, room temperature 6.1( $\pm 4.4$ )mm, heated 9.3( $\pm 6.8$ )mm, and using our new heating system 1.5( $\pm 3.1$ )mm. Significant differences were not seen in the first 4 groups, but with our new heating system the VAS was substantially lower. Conclusion: This study showed that controlling the temperature of the local anesthetic reduces the pain of the injection. We conclude that the crucial factor in reducing the pain is to maintain the temperature of the anesthetic solution at 38C.

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