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EFFECT OF LOW INTENSITY PULSED ULTRASOUND ON A HUMAN TOOTH SLICE ORGAN CULTURE

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Aim: To investigate the effect of therapeutic Low Intensity Pulsed Ultrasound effect on the human dentin pulp complex in an in vitro tissue culture model.

Materials and Methods: Ninety-two premolars were extracted from 23 adolescent orthodontic patients [mean age was $14y-5m \pm (2y-3m)$] whose orthodontic treatment required premolar extraction. All the premolars were cut transversely into 600 μm thick slices (8-11 slices per tooth). The slices were divided into two main groups according to the frequency at which LIPUS was applied (single application and daily application). The groups were further subdivided into five subgroups (5, 10, 15 and 20 minutes and one control group). The tooth slices were cultured at 37°C in an atmosphere of 5% CO₂ in air, in a humidified incubator, with the medium changed after 24 hours and then every 48 hours. LIPUS was applied using a 2.5 cm² transducer that produces incident intensity of 30 mW/cm² of the transducer's surface area. After 5 days of culture tooth slices were fixed, demineralised and processed for histomorphometrical analysis (to measure the Predentin layer thickness PD, and odontoblast cell numbers OD) and real time PCR to investigate changes in expression of genes of interest (Collagen I, DMP1, DSPP, TGF β 1, RANKL and OPG).

Results: The histomorphometric analysis revealed that the predentin thickness was higher in the single application group (10, 5 and 15 minutes) respectively than in the daily application LIPUS treatment group and the control groups. These 3 groups (10, 5 and 15 minutes/ single application) were not significantly different from each other. The odontoblast cell count was higher also in the single application groups mainly in the 5, 10 and 15 minutes respectively than in the control and other treatment groups. Also, they were significantly different from each other. Real time PCR demonstrated no statistical significant difference between the groups in the expression of Collagen I, DMP1 and TGF β 1. All groups expressed DSPP, RANKL and OPG at a low level which were not significantly different.

Conclusions:

- LIPUS appeared to increase in the predentin layer thickness and odontoblast cell numbers following a single application for 5, 10 and 15 minutes.
- No significant difference in expression of Collagen I, DMP1 and TGF β 1 was observed in these LIPUS stimulated cultures when compared to controls.
- Very low expression of DSPP, RANKL and OPG from cells within dentin pulp complex in this in-vitro model after 5 days of culture.

(* Presenter)