



Interspecies variation in Ca/P at different depths of root dentine

3503



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Aims

- To compare the ratio of calcium to phosphorus in root dentine from human, ovine and bovine specimens.
- To investigate the variation in the calcium: phosphorus ratio, with relation to distance from the root canal lumen, in human, ovine and bovine root dentine specimens.

Introduction

It is increasingly difficult to secure uniform collections of human teeth for dental research, and the use of animal teeth has been suggested (1). We are currently investigating sub-surface dentine changes caused by the use of NaOCl and EDTA for root canal irrigation, and wished to investigate whether animal teeth were a valid alternative to human teeth. The greater the similarity between teeth of specific animals and human teeth the more likely these teeth will be a suitable model for human teeth. This study tested the hypotheses that Ca/P ratios in human root dentine would be similar to those in ovine and bovine root dentine, and that Ca/P ratios would not differ significantly at increasing distance from the root canal lumen.

Methods

- Horizontal sections from the cervical third of human, ovine and bovine roots (n=5 each) were prepared with a circular diamond saw at 5rpm under constant water irrigation, and stored in 1% chloramine-T (w/v).
- After embedding in clear resin, specimens were sequentially polished with P600, P800, P1000 and P1200 abrasive papers, followed by aluminium oxide, 1µm, 0.3µm and 0.05µm to remove the saw-generated smear layer.
- Ca/P ratios were determined at 0µm, 100µm, 200µm, 300µm and 1000µm from the root canal lumen by energy dispersive x-ray spectrometry (EDAX) (JEOL JSM 5300LV) (figure 1).
- Results were analysed using the non-parametric Kruskal-Wallis and Mann-Whitney U tests (p<0.05).

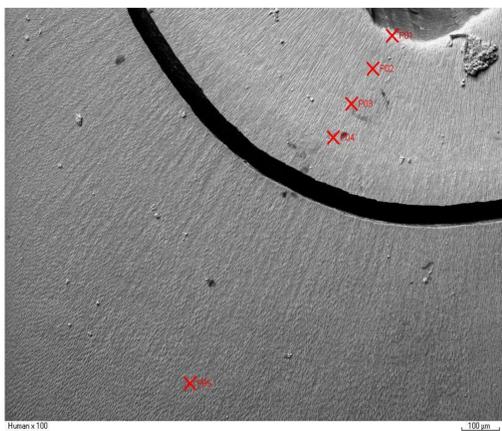


Figure 1: Typical SEM photograph showing locations at which EDAX measurements were taken at intervals from the canal lumen (x), 0µm, 100µm, 200µm, 300µm and 1000µm.

Results

- Figure 2 shows the median Ca/P ratios of ovine, bovine and human dentine at increasing distances from the root canal lumen.
- There were significant differences in the Ca/P ratios between ovine and bovine dentine, and between ovine and human dentine at points up to 300µm from the canal lumen (p<0.05).
- The Ca/P ratio of bovine dentine was significantly different from that of human at the root canal lumen (0µm) only (p<0.05) (figure 2).

Median Ca/P ratios (wt/wt) of ovine, bovine and human teeth

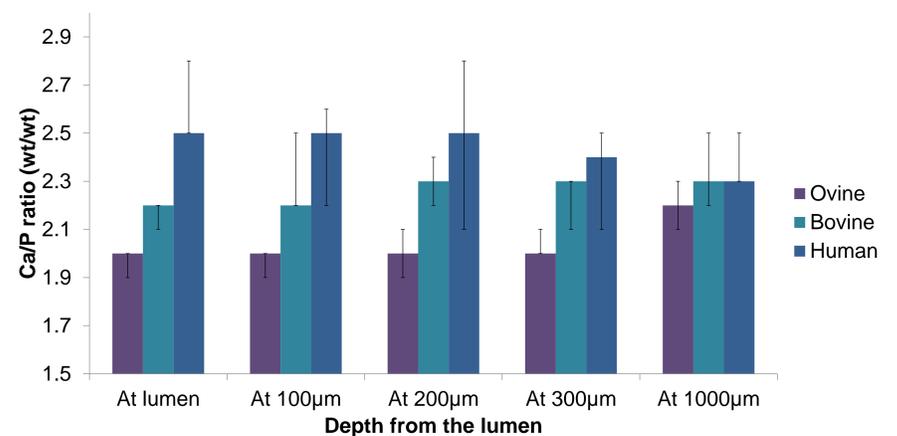


Figure 2: Median Ca/P ratios of for each species at different depths from root canal lumen. The error bars are the maximum and minimum values for each group.

Discussion

- Approximately 45 wt% of dentine is composed of a mineral phase, the major components of which are calcium and phosphorus (2,3). Consequently, to develop a suitable animal model to study the effects of different endodontic irrigants on root dentine, we measured the Ca/P ratio for two candidate species.
- Careful analysis of the results reveals that at the lumen both animal species had significantly lower Ca/P ratios compared to human specimens.
- We also studied the variation in Ca/P ratio with respect to distance from the lumen for all species in order to inform our studies on sub-surface tissue changes.
- Bovine specimens showed no significant differences in Ca/P ratio compared to human teeth at any depth between 100 and 1000µm from the lumen. In contrast, ovine specimens exhibited a significantly lower Ca/P ratio, when compared to human dentine, at all depths other than 1000µm, where there was no significant difference.

Conclusions

- There were significant differences in the Ca/P ratios of inner root dentine in ovine, bovine and human teeth. This may have implications for the transferability of research data involving demineralising treatments conducted on animal teeth.
- In deeper areas of dentine Ca/P ratio values of bovine and human teeth showed no significant differences.

References

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