



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

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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).

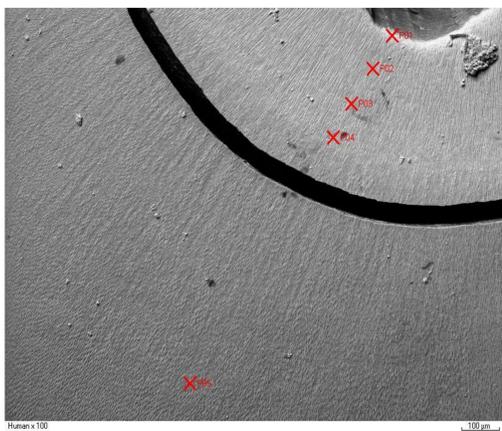


Figure 1: Typical SEM photograph showing locations at which EDAX measurements were taken at intervals from the canal lumen (x), 0µm, 100µm, 200µm, 300µm and 1000µm.

## 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

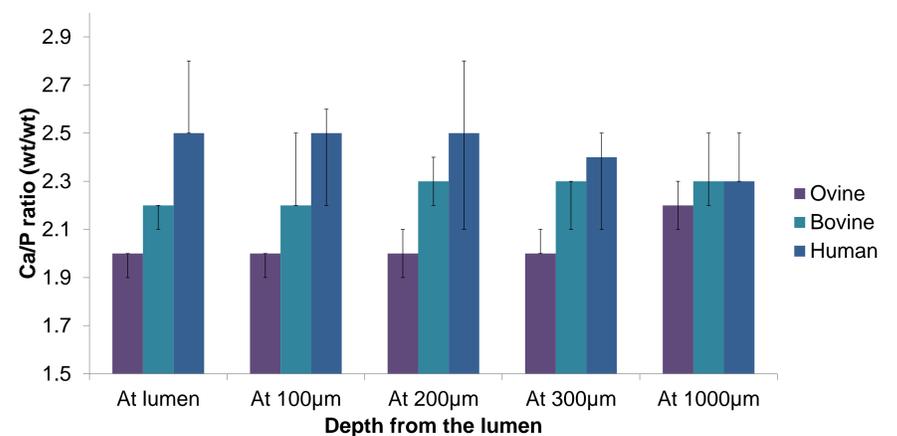


Figure 2: Median Ca/P ratios of for each species at different depths from root canal lumen. The error bars are the maximum and minimum values for each group.

## 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

- Fonseca RB, Haiter-Neto F, Fernandes-Neto AJ, Barbosa GAS, Soares CJ (2004). Radiodensity of enamel and dentin of human, bovine and swine teeth. *Archives of Oral Biology*. 49:919-922.
- Arola D, Ivancik J, Majd H, Fouad A, Bajaj D, Zhang X-Y, et al. (2009). Microstructure and mechanical behaviour of radicular and coronal dentin. *Endodontic Topics* 20:30-51.
- Dogan H, Çalt S (2001). Effects of Chelating Agents and Sodium Hypochlorite on Mineral Content of Root Dentin. *Journal of Endodontics* 27:578-580.