Sandra Fletcher BSc(Hons) PGCE DipAVN(Surgical) RVN A1

Sandra qualified in 1998. She went on to work in referral nursing, where she gained an Advanced Diploma (2003) and an honours degree (2006). She then moved on to veterinary nursing education, and recently gained the PGCE (2015). Her current interest is evidence-based veterinary nursing.
Email: sandra_whiting@hotmail.com

Evidence-based veterinary medicine: Should we be polishing teeth?

Sandra Fletcher BSc(Hons) PGCE DipAVN(Surgical) RVN A1
Boness Veterinary Hospital, 125 Bedford Road, Barton-Le-Clay, Bedfordshire, MK45 4LP, UK

ABSTRACT For decades professional periodontal therapy has included scaling and polishing of patient's teeth under anaesthesia. Periodontal therapy also includes clinical evaluation, supra and sub-gingival cleaning, sulcal lavage, periodontal probing, evaluation and charting, as well as radiographs and a home care plan. As part of a taught syllabus and through practice protocol, veterinary nurses have become proficient at this part of Schedule 3 procedures. Recent continuing professional development (CPD) has indicated a change in practice, suggesting that polishing is no longer recommended. An evidence-based question was formulated: 'In companion animals undergoing professional periodontal therapy, does polishing have an effect on enamel?' A literature search was performed which included veterinary nursing, veterinary and dental research, this was then critically analysed. The findings indicate that there is no evidence to suggest a change to clinical practice is currently needed.

Introduction

Periodontal disease is generally accepted to be the most common presentation of oral disease in companion animals (Ingham & Gorrel, 2001; Johnston, 2012; Perry & Tutt, 2015; Robinson, 2011). As such, professional periodontal therapy remains a common treatment within veterinary practice in the UK.

The causes of periodontal disease are known, and result from the proliferation of pathogenic plaque bacteria on the surface of the tooth. Healthy oral cavities contain many commensal species of bacteria within the tooth biofilm. Research is on-going into identifying which bacteria are more likely to lead to clinical disease. Plaque is soft and difficult to identify with the naked eye unless disclosing fluid is used. The plaque bacteria cause an inflammatory response in the periodontal tissues, resulting initially in gingivitis. This is reversible with removal of the plaque but if the plaque is not removed saliva and other oral fluids deposit minerals, causing the formation of calculus. The rough surface of the calculus provides a perfect environment for the attachment of further plaque bacteria. Without treatment, the accumulation of plaque bacteria leads to periodontitis (**Figure 1**), when structures that attach the tooth to the jaw bone are progressively broken down (**Figure 2**) (Perry & Tutt, 2015).

Under the guidance of the Code of Professional Conduct for Veterinary Nurses (RCVS, 2015), Registered Veterinary Nurses (RVNs) are permitted by the Veterinary Surgeons Act 1966 (Schedule 3 Amendment) to perform routine dental hygiene work. Bloor (2009) outlined the legally permitted tasks that could be performed under Schedule 3 including the scaling and polishing of teeth and clarified that as the scaling process leaves scratches on the surface enamel, leading to more rapid plaque build-up following dental treatment, polishing is employed to leave a smooth surface. This rationale is also advocated by Aspinall (2012 and 2014), and Donovan (2010). Conversely, Robinson (2011), a dentist working in the veterinary referral context, asserts that polishing is ineffective at removing scratches, and provides little therapeutic benefit.

Figure 1. Severe periodontitis

Figure 2. Breakdown of attachments to the tooth

Evidence from veterinary research

Niemiec (2008) emphasises that in human dentistry the expertly trained dentist leaves minimal damage on the enamel surface. By contrast, less-experienced veterinary staff may be more likely to leave scratches and therefore polishing remains necessary. This assertion is supported by Janalik, Fichtel, Sperka, Omasta and Rauser (2014) in the findings of a randomised controlled trial (RCT), which explored operator technique and the severity of damage to the enamel. Statistical analysis showed that using the tip of the scaler caused significantly more damage than using the side, and that increased contact time corresponded with increased damage. The study sample was representative of patients seen in veterinary practice, and randomised selection into study groups strengthened the results.

The study had two significant weaknesses: firstly, the person performing the dentistry was not blinded to the nature of the study, and an element of personal bias may have resulted in uneven pressure being placed on the scaler during certain interventions. The bias could have arisen because the individual may have placed increased pressure on the scaler tip and less on the side, potentially swaying the results. Other studies used equipment to apply measured pressure to each sample, removing the human factor. Secondly, teeth selected for the trial were only assessed visually, potentially missing significant microscopic damage already present. The validity of the findings may thus have been affected by these flaws in methodology. However they were justified by the assertion that this approach enabled the study to generate more realistic and representative data, similar to the conditions within veterinary practice.

Brine, Marretta, Pijanowski and Siegel (2000) conducted a similar RCT evaluating the effects of different scaler hardware on dog tooth enamel. In contrast to Janalik et al. (2014), Brine measured the pressure applied to each tooth, thus avoiding the risk of bias. The enamel surface was also assessed prior to the intervention. Brine et al. concurred that enamel damage could be increased through variations in technique. The study found that an increase in the pressure applied to the scaler correlated with an increase in damage sustained. In addition, the use of rotosonic scalers was not advised due to the level of enamel damage they caused. These scalers are non-cutting burs that vibrate calculus away using a high-speed handpiece.

A similar study by Fichtel, Crha, Langerova, Biberauer and Vlaín (2008) used an RCT to assess the effects of both scaling and polishing on enamel. Teeth were used which were identified as requiring extraction from canine patients due to the presence of clinical pathology. The teeth were scaled and polished before being removed and analysed. Researchers compared the efficacy (how well calculus was removed) and the level of enamel damage caused using varying combinations of intervention. The findings revealed:

- The use of powered instrumentation (ultrasonic scaler) and hard polishing wheel (prophy cup) resulted in the most efficient removal of calculus, but also the most enamel damage.
- Powered instrumentation was more effective than manual calculus removal.
- Scaling and polishing resulted in more efficient calculus removal than scaling alone.
- Enamel damage did not increase with the use of a soft polishing wheel (prophy cup) and fine paste (<40 µ).
- Enamel damage increased significantly with the use of semi-soft and hard polishing wheels.

These results were strengthened by the use of both positive and negative controls, and the scoring of the teeth was performed by individuals blinded to the method of dentistry, limiting individual bias. However the study did have two weaknesses: the small sample size and the lack of statistical analysis, which would have strengthened the value of the data. However, the results are useful and the study itself is a significant catalyst for future research, identifying ways the methodology could be improved.

Evidence from dental research

As early as 1967, dentists were becoming concerned about the risk of damage to human tooth enamel during polishing (Vrbic, 1967, cited by Pence, Chambers, van Tets, Wolf & Pfeiffer, 2011). Subsequent studies raised concerns that fluoride-rich enamel was lost as a result of the process and that patients could be educated to use good plaque removal techniques at home thus reducing the need for the procedure.

Pence et al. (2011) described a change in human dentistry practice to *selective* polishing, in which only those teeth displaying stain were polished, for aesthetic purposes. They conducted an RCT to establish the approximate lifetime enamel loss due to polishing. This is the largest study to date, and involved calculating a maximum number of polishing procedures a person may receive in a lifetime; this was calculated to be 150. The findings confirmed that statistically significant abrasion of enamel was experienced in premolars, but was not proven to occur in molars. However, even the enamel loss in premolars was less than previous studies had suggested.

These findings are difficult to apply to a veterinary setting, as differences in tooth structure/previous care may greatly alter the effects of the intervention. In addition, the factor of less rigorous training in periodontal therapy may result in significantly more damage in veterinary practice. However, it is important to note that no veterinary patient would undergo 150 scale-and-polish procedures in a lifetime, allowing the assumption that less frequent polishing in veterinary patients would incur significantly less erosion to the enamel than in those documented in the study. Differences between canine and human enamel also need to be explored. Veterinary-based research is therefore recommended.

Interestingly, Pence et al. (2011) found dental polishing produced significant damage to root surfaces, in excess of the damage to the rest of the crown, as the samples had been extracted prior to polishing and the roots were therefore exposed. This unintentional finding is echoed in another RCT undertaken by Yurdaguven, Aykor, Ozel, Sabuncu and Soyman in 2012. This study set out to compare the effects of polishing with a prophy cup and paste on enamel, dentine and other surfaces found more commonly in human dental restoration (e.g. porcelain and composites). The findings confirmed that polishing increases surface roughness (compared to pre-polishing data) in all surfaces tested. However, even using a contact time of 12 seconds (more than the maximum of 5 seconds recommended by Niemiec [2008] and Pence et al. [2011]), the results found that the degree of enamel and dentine damage did not exceed a significant level. Previous research (Bollen, Lambrechts & Quirynen 1997) had identified the level of surface roughness that will increase the retention of bacteria as 0.2µ. As the roughness (depth of grooves) increases, the number of retained bacteria increases. In this study, the damage to enamel and dentine did not exceed 0.2µ. A fine abrasive paste was used (1 µ, when the scale ranges from 1–177 µ), which may differ from those used in veterinary practice. A small sample size and lack of teeth representative in veterinary practice are significant weaknesses, however the results are in agreement with Pence et al. (2011).This would indicate that care should be taken to avoid or limit polishing of damaged enamel or dentine, to avoid additional surface damage and bacteria retention.

Evidence summary

There is no primary veterinary nursing research available to answer the evidence-based question. Primary veterinary research is available, but limited, and spans 2000-2014. Primary human dental research on this subject was more readily available, and papers used to answer the question spanned 2008-2011.

There is strong evidence to confirm the assertion that scaling causes enamel damage (Brine et al., 2000; Fichtel et al., 2008; Janalik et al., 2014; Niemiec, 2008). This damage is dependent on operator performance: there is a positive correlation between increased contact time and/or pressure and extent of damage (Brine et al., 2000; Janalik et al., 2014). Additionally the type of scaler used can affect the level of damage (Brine et al., 2000), with the rotosonic scaler being deemed too damaging to recommend its use in clinical practice.

A correlation between powered instrumentation and more efficient removal of calculus was demonstrated (Fichtel et al., 2008), and scaling and polishing resulted in more efficient removal of calculus than scaling alone. The use of fine-grade (1–45 µ) prophylaxis paste was recommended (Fichtel et al., 2008; Yurdaguven et al., 2012), and, when applied with a soft polishing wheel, it was found that this avoids an increase in enamel damage (Fichtel et al., 2008). There is evidence that other surfaces can be damaged through routine polishing (Pence et al., 2011; Yurdaguven et al., 2012), specifically eroded enamel, dentine and roots.

The evidence suggests that results can vary depending on the anatomy of the tooth (Pence et al., 2011), suggesting that studies conducted on species-specific subjects would be necessary to strengthen the evidence. There is also a significant discrepancy in the number and frequency with which professional periodontal therapy is performed in human and veterinary fields (Pence et al., 2011). Therefore care should be taken when appraising human dentistry research.

Recommendations for clinical practice

The literature search and analysis did not produce sufficient evidence to support a significant change in clinical practice. Based on this evidence, polishing should continue to be used within veterinary practice until further studies can demonstrate that it is either harmful or ineffective.

The recommendations for RVNs performing professional periodontal therapy remain as follows:

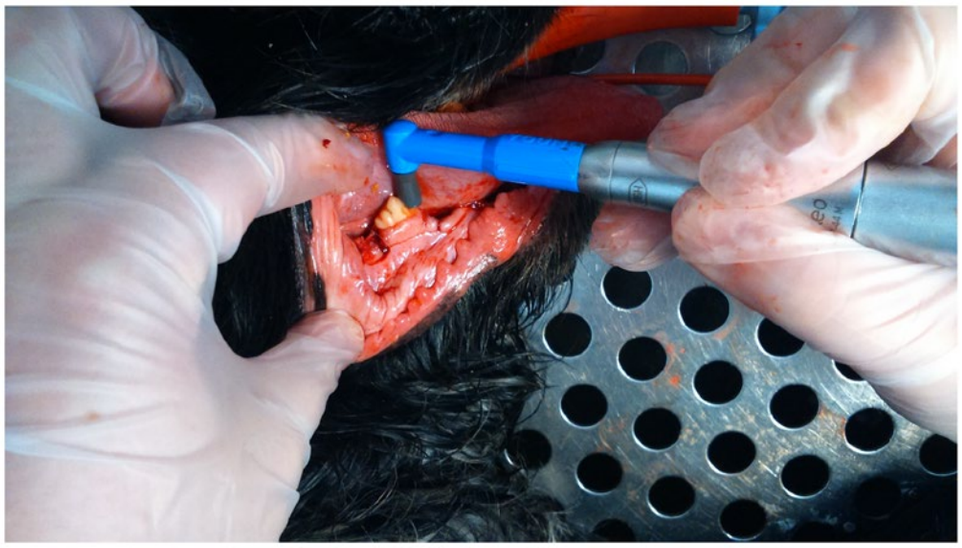

Figure 3. Slow-speed handpiece in use

- To prevent significant damage to enamel surfaces when scaling:
  - apply light pressure using a modified pencil grip
  - use the side of the scaler to touch the enamel, not the tip
  - ensure the water spray is flowing to reduce the temperature of the tooth/scaler
  - use the minimum contact time possible to reduce heat (<5 seconds) – return to the tooth later if necessary to avoid prolonged contact
  - move the scaler constantly to avoid severe enamel damage – more than 5 seconds in one position demonstrated significant damage
- When polishing teeth after scaling:
  - use a fine-grade abrasive prophylactic paste (<40 µ), and reapply frequently
  - use a soft prophy cup
  - apply only enough pressure to flare the edges of the cup, using a slow-speed handpiece (no greater than 3000rpm) (**Figure 3**)
  - use the minimum contact time possible – in excess of 5 seconds is not recommended
  - avoid or limit the use of a polishing cup on damaged enamel, dentine or cementum

Further research

There is a significant lack of veterinary-based evidence in this area. Extrapolating significant data from human studies is difficult, leading to less confidence in making changes to veterinary practice. Specific areas in which veterinary research needs to be performed would include an evaluation of the:

- level of training received by staff performing scaling and polishing
- staff understanding of the procedure, including the risks to the patient
- qualification/experience level of the operator
- frequency with which the procedure is performed
- introduction of follow-up appointments/procedures to determine the presence of significant differences in plaque build up after polishing/not polishing
- post-procedure differences between patient's homecare routine after a scale and polish, and the long-term outcome

All of these research proposals could be investigated by RVNs in practice.

Conclusion

Evidence-based veterinary medicine is an important tool that can enable the practitioner to answer clinical questions. Changes to practice should only be made following evaluation of the evidence, and the undertaking of clinical research to quantify the benefits of change scientifically. In this example, it was found that the evidence demonstrated that there was no need to change current practice. In addition it has helped to identify where further research is needed. Both evidence-based veterinary medicine and research are vital to the progression of the profession.

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