MORPHOMETRIC CHARACTERISTICS OF THE FIRST PREMOLAR (WOLF TOOTH) IN HORSES, WITH SPECIAL REFERENCE TO ITS CLINICAL IMPORTANCE

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Summary


Wolf tooth is a common term used to describe the first premolar, a functionless remnant from modern horse’s ancestors. This study was performed to reveal possible relationships between morphometric characteristics of wolf tooth and its clinical importance in animal’s health. A total of 158 wolf teeth were extracted from 83 horses from 1.5 to 15 years of age during a period of one year and divided into two groups based on the age of the animals: Group 1, up to 3 years old and group 2, over 3 years old. Crown length, root length, neck width and crown/root ratio of the teeth were measured using a Vernier caliper. Crown length, root length and neck width decreased significantly in group 2, while the crown/root ratio was considerably increased. Crown length exhibited a significant correlation (P<0.05) with root length in group 1, while this correlation was stronger (P<0.01) in group 2. Crown length was significantly correlated with neck width (P<0.01) in both groups, but there was no significant correlation between root length and neck width in both groups. Also, crown length and root length were negatively and significantly related (P<0.01) with age in both studied groups and became shorter. The results revealed that the crown of the wolf tooth could be a more reliable indicator for estimation of the root length in horses over 3 years of age than in those under 3 years and that in younger horses this criterion had a lower potential to predict the root length.

Key words: first premolar, horse, morphometry, wolf tooth

INTRODUCTION

The earliest equid, Hyracotherium, has a dental formula of three incisors, one canine, four premolars, and three molars (3 : 1 : 4 : 3) on each side of upper and lower jaws. The canine is large and sexually dimorphic (Gingerich, 1981). The premolars are primitive in structure, and roughly triangular in shape, whereas the molars are relatively square and have a greater surface area for trituration. Mor-
Morphometric characteristics of the first premolar (wolf tooth) in horses, with special reference...
tal speculum was used to provide optimum visualisation. For local anaesthesia, approximately 1.5 to 2 mL of mepivacaine hydrochloride solution (2%; Carbocaine-V, Pfizer Animal Health) was injected submucosally between the gingiva and palatine mucosa on the palatal side of the wolf tooth. Moreover, 1 to 2 mL of local anaesthetic solution was injected submucosally on the buccal side of the wolf tooth at the junction of the gingival and cheek mucosa. Then, the gingival tissue and periodontal attachments were elevated from the root and crown and the loosened tooth was removed with forceps. All teeth were extracted without any kinds of fractures. In 75 cases, the extraction was done bilaterally and in 8 cases unilaterally. Totally, 158 wolf teeth were obtained. The teeth were divided into two distinct groups based on the age of the animals: group 1 comprising horses <3 years old and group 2: >3 years old. Teeth were subjected to morphometric measurements. The determined parameters (crown length, root length, width at neck and crown/root ratio of the teeth) were measured using a Vernier caliper (200 mm; Mitutoyo Corp., Kawasaki, Japan; resolution 0.05 mm, graduation 0.05 mm, accuracy ± 0.05 mm). All parameters were measured three times and the mean values were recorded.

Statistical analysis

The statistical software SPSS v. 19.0 for Windows (SPSS Corp., Chicago, IL) was used to compute the means and standard deviation (SD) of all parameters. The independent sample t test and Mann-Whitney test were used to compare the groups. The correlations between studied measurements and fixed effects of age on them were determined. P values of <0.01 and <0.05 were regarded as statistically significant.

RESULTS

Except for one case, all obtained teeth in this study were upper wolf teeth (Fig. 1). Fig. 2 shows a wide variety of size and shape of occlusal surface of wolf teeth in different age groups.

Minimum, maximum and mean±SD for the measured morphometric parameters are presented in Table 1. Comparison of the mean values of variables in studied groups revealed significant decrease (P<0.05) of crown length, root length and neck width in the group > 3 years of age. Subsequently, the crown/root ratio was significantly higher (P<0.05) compared to the group > 3 years of age (Table 1).

In horses up to 3 years old, crown length was significantly correlated (P<0.05) with root length, while this correlation in horses older than 3 years of age was more significant (P<0.01) (0.29 and 0.54 respectively) (Table 2). Crown length was significantly correlated with neck width (P<0.01) and crown/root ratio (P<0.05) in both groups. However, there was no significant correlation between neck width
Morphometric characteristics of the first premolar (wolf tooth) in horses, with special reference to their crown length and root length in both groups. Also, crown length and root length exhibited significant negative correlation (P<0.01) with age in both studied groups (–0.42 and –0.83, –0.76 and –0.79 respectively).

The crown/root ratio and age were significantly related (P<0.01) in the group under 3 years of age, but not in the older group of horses (P>0.05).

Fig. 2. Wolf teeth in a wide variety of size and shape of occlusal surface in horses up to 3 years of age (upper row) and over 3 years of age (lower row).

Table 1. Morphometric parameters of the wolf tooth (mm) in horses < 3 years of age (Group 1) and horses > 3 years of age (Group 2). Data are presented as mean±SD

<table>
<thead>
<tr>
<th>Measured parameters</th>
<th>Group 1 (n=55)</th>
<th>Group 2 (n=30)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Max</td>
<td>Min</td>
</tr>
<tr>
<td>Crown length</td>
<td>10.6</td>
<td>5.6</td>
</tr>
<tr>
<td>Root length</td>
<td>22.0</td>
<td>7.4</td>
</tr>
<tr>
<td>Neck width</td>
<td>11.5</td>
<td>4.9</td>
</tr>
<tr>
<td>Crown/root ratio</td>
<td>0.99</td>
<td>0.33</td>
</tr>
</tbody>
</table>

significantly different at P<0.05 between groups.

Table 2. Spearman correlation coefficients between studied morphometric parameters¹ in horses < 3 years of age (Group 1, above the diagonal) and horses > 3 years of age (Group 2, below the diagonal)

<table>
<thead>
<tr>
<th>Crown length</th>
<th>Root length</th>
<th>Neck width</th>
<th>Crown/root ratio</th>
<th>Age</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crown length</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Root length</td>
<td>0.54**</td>
<td>0.29*</td>
<td>0.38**</td>
<td>0.34*</td>
</tr>
<tr>
<td>Neck width</td>
<td>0.78**</td>
<td>0.31</td>
<td>0.18</td>
<td>−0.75**</td>
</tr>
<tr>
<td>Crown/root ratio</td>
<td>0.43*</td>
<td>−0.44**</td>
<td>0.42</td>
<td>0.18</td>
</tr>
<tr>
<td>Age</td>
<td>−0.76**</td>
<td>−0.79**</td>
<td>−0.61**</td>
<td>0.04</td>
</tr>
</tbody>
</table>

* P < 0.05; ** P < 0.01.

1. The measured parameters are: crown length, root length, neck width, crown/root ratio, and age.
DISCUSSION

During eruption of the adjacent permanent second premolar, approximately at 30–36 months of age, the root of wolf teeth began to be resorbed (Sisson & Grossman, 1975). Wolf teeth have a root of variable length up to 30 mm (Dixon, 2005; Dixon & Dacre, 2005). In our study, the longest root (22 mm) was seen in a 20-month-old horse from group 1, while in group 2 the longest root (10.7 mm) belonged to a 48-month-old horse. According to the obtained results, crown length had a significant correlation with root length in all ages and this correlation was stronger and more significant in animals aged over 3 years (P<0.01). In contrast to our finding, Easley et al. (2011) mentioned that the size and shape of the crown were not necessarily a reflection of the size or shape of the root.

On the other hand, crown and root length in both groups had negative significant correlation with age (P<0.01) and became shorter, but their ratio (crown/root ratio) showed a significant correlation (0.53, P<0.01) with ages up to 3 years and no correlation (0.04, P>0.05) with ages over 3 years. This absence of significant correlation between crown/root ratio and age over 3 years may be attributed to the proximity of the values of the roots in this group.

There was no significant correlation between neck width and root length in both groups while the correlation between neck width and crown length in all ages was significant (P<0.01). As a result, for root length estimation, different criteria should be considered with regard to age. In horses over 3 years of age, the crown of the wolf tooth could be a more reliable indicator than in animals below 3 years of age. In younger horses these criteria are less reliable to predict the root length.

Mandibular wolf teeth are uncommon (Nickel et al., 1979) and in this study also, only one case of lower wolf tooth was seen. The occlusal surface of the wolf teeth in this study had various shapes (Fig. 2) in agreement to literature reports (Easley et al., 2011).

The role of wolf teeth in causing biting discomfort and the decision whether to extract them or not are still controversial (Lane, 1994; Gaughn, 1998). Due to their placement in the interdental space right in front of the second premolar, wolf teeth can easily cause problems in ridden horses by interfering with the bit and cause pain and major training problems (Johnson, 2010). Normally placed but enlarged wolf teeth may cause oral pain and buccal laceration due to bit contact, especially when the bit or the noseband force the cheeks onto occasional sharp protuberances of the wolf teeth (Dixon & Dacre, 2005; Johnson, 2010). Furthermore, loose wolf teeth may shift under bit pressure and irritate the gum (Dyce et al., 1987). Therefore, their presence is blamed for many behavioural problems (Dixon & Dacre, 2005), such as, for example, notable unsteadiness in the mouth and the head itself during riding. Consequently, many experts advise to extract wolf teeth in horses that carry a bit.

However, it should be pointed that wolf teeth extraction is not necessarily an innocuous procedure, as all or part of their crown can be hidden beneath soft tissue and their crowns can be large and deeply embedded (Dixon & Dacre, 2005). Consequently, their extraction can cause damage to the hard palate and the enclosing soft tissues. Although normal sized and positioned wolf teeth have been found in older riding horses competing at a very high level, that have no history of bitting problems. Maybe the decision whether to
extract wolf tooth or not should be made based upon their size and placement and whether they are loose or not, in order to avoid the above mentioned, possible complications.

Fractures of wolf teeth’s roots and remaining part of them after extraction can lead to permanent, painful, local swellings, which cause biting problems that may not have been present before. For this reason, understanding length and anatomical characters of root is of clinical importance for practitioners.

In conclusion, it should be considered that the length of crown could be an approximately reliable indicator to predict the root length in horses older than 3 years. However, in younger animals, the size of crown had a lower potential to predict the root length. This finding will be useful for practitioners to design an appropriate plan for wolf tooth extraction.

REFERENCES


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