Effectiveness of an Enzymatic Rawhide Dental Chew to Reduce Plaque in Beagle Dogs

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Summary:

Tooth brushing is considered a superior technique for reducing plaque accumulation. Other methods of maintaining oral hygiene have been investigated since many owners may not be willing or able to brush their dog's teeth. Following a professional teeth cleaning procedure, 11 dogs were offered a rawhide dental chew BID for 7-days, while 11 other dogs were fed the same diet without receiving the chew device. Dogs in the treatment group had significantly less plaque formation during the trial period compared with dogs in the control group. The rawhide dental chew provided in the study reported here decreases plaque formation in the short-term and may be beneficial in the prevention of progressive periodontal disease associated with attachment loss if provided on a long-term basis. J Vet Dent 18(2); 61-64, 2001

Introduction

Periodontal disease is a group of dental plaque-induced diseases. Accumulation of supra-gingival plaque on the tooth surface is responsible for the development of an inflammatory reaction of the surrounding gingiva. Gingivitis may be chronic in nature or progress to periodontitis. All dogs with inadequate oral hygiene will develop gingivitis which often progresses to periodontitis with possible severe destruction of tooth supporting tissues. Control of dental plaque accumulation prevents development and progression of gingivitis. Plaque control is best achieved by regular tooth brushing. However, the effectiveness of tooth brushing is linked to the frequency and quality of this activity. Brushing teeth once each day in dogs with gingivitis was able to restore gingival health whereas brushing once or three times a week was not effective. A survey of owners who had been educated about tooth brushing and oral hygiene techniques after periodontal treatment of their pet revealed that 53% of them were still practicing tooth brushing several times a week after 6-months.

Although tooth brushing is considered a superior technique for reducing plaque accumulation, other methods of maintaining oral hygiene have been investigated since many owners may not be willing or able to brush their dog's teeth. In the 1960's, the anti-plaque effect of chewing a fibrous diet was studied in dogs. Beagle dogs fed whole raw bovine trachea with the attached esophagus and associated muscles had less plaque accumulation and gingival fluid exudation than a group of dogs fed the same, but minced diet. Multiple, more recent studies have evaluated chew objects and chewing activity on the mechanical removal of plaque and/or calculus. Although rawhide chews have been on the market for several years, only one report has compared the effectiveness of a plain rawhide chew with a cereal biscuit on calculus accumulation in dogs. The author is not aware of any previous studies which have investigated the ability of rawhide dental chews to reduce plaque. The purpose of the study reported here was to evaluate the plaque reduction effect of a commercial rawhide dental chew in a standardized clinical trial.

Materials and Methods

Twenty-two female beagle dogs, age 13 to 22-months, and weighing 8.4 - 12.7 kg were selected. All dogs in the study had normal mesio-occlusal occlusion, full dentition, and absence of periodontitis (no attachment loss). All dogs had varying degrees of plaque and calculus accumulation. The study was conducted in an approved animal care facility.

In a pre-trial test, the first 11 dogs accepting and spontaneously chewing the rawhide dental chews were included in the treatment group. The remaining 11 dogs were included in the control group. All dogs had their teeth thoroughly scaled and polished while receiving general anesthesia at the beginning of the study (day 1). During the 7 days of the clinical trial, dogs were fed commercial extruded pellets and water ad libitum. In the treatment group, large rawhide dental chews were offered BID. These chews were first provided less than 6-hours following standard scaling/polishing procedures. The technician distributing the chews assessed each dog's reactions to the chews at each occasion and reported them in a chart. Eleven teeth were scored in each dog, bilaterally (22 teeth total): maxillary third incisor, canine, second, third, fourth premolar, and first molar teeth; and, the mandibular canine, second, third, fourth premolar, and first molar teeth. All dogs received general anesthesia on day 8 and plaque accumulation was assessed using two standard dental scoring systems.

Modified Silness and Loe plaque index

The tooth surface was gently rinsed with a water-dispensing bottle and gently dried with the air syringe of the dental unit. Plaque was detected first based on visual examination, then assessed by probing the neck of the tooth along the gingival margin and determining the amount of plaque collected in this manner. Four sites (disto-facial, facial, mesio-facial, lingual) were evaluated in the original index system. The modification used here included three
sites on each tooth (distofacial, facial, and mesiofacial). A
pair of 2.5 X magnification glasses were used to differenti-
ate between a score of 0 and 1 when no plaque was seen on
initial visual examination.

0 = no plaque in gingival area.
1 = film of plaque adhering to the free gingival margin. The
plaque may only be recognized by running a probe across
the tooth surface at the entrance of the gingival sulcus.
2 = moderate accumulation of soft deposits within the gingival
sulcus or pocket, on the gingival margin and/or adjacent
tooth surface which can be seen on visual examination.
3 = abundant soft matter within the gingival sulcus or pocket,
and/or on the adjacent tooth surface which can be seen
on visual examination.

Turesky plaque index15
The entire buccal surface is observed. Plaque is disclosed
using erythrosin solution and only plaque coverage is assessed.

0 = No plaque
1 = Separate flecks of plaque at the cervical margin of the
tooth.
2 = A thin continuous band of plaque (< 1 mm) at the cervical
margin of the tooth.
3 = A band of plaque (> 1 mm) but covering less than 1/3 of
the crown of the tooth.
4 = Plaque covering at least 1/3 but less than 2/3 of the crown
of the tooth.
5 = Plaque covering 2/3 or more of the crown of the tooth.

Statistical analysis was performed using a Student’s t-test
to compare the means (±SD) in treatment and control groups.
A value of p < 0.05 was considered significant.

Results
Chewing behavior
On day 1, when initially presented with the rawhide den-
tal chew, 8 of 11 dogs chewed less than 5 - 10 times. Most
dogs were chewing more than 5 - 10 times on the rawhide
dental chew and were still chewing after 15 minutes by day 4
(Figs. 1 and 2).

Plaque scores
There was a significant difference between mean plaque
scores for maxillary and mandibular teeth. Dogs in the treat-
ment group had significantly lower plaque scores for max-
illary and mandibular teeth, and all evaluated teeth com-
pared with dogs of the control group (Figs. 3 and 4). The
mean (±SD) Silness and Löe plaque index score was 18.0
% and 20.0 % less for the treatment group compared with
the control group for maxillary and mandibular teeth, respec-
tively. The mean (±SD) Turesky plaque index score was 19.6
% and 18.4 % less for the treatment group compared with
the control group for the maxillary and mandibular teeth, re-
spectively.

Discussion
The effect of a chewing device on plaque accumu-
lation depends on the intrinsic ability of the device to remove
plaque from the tooth surface and on the willingness of the
dog to use it. The result of both components could be con-
sidered relevant to its clinical effectiveness. A device con-
sidered to have intrinsic value in reducing plaque would
never have clinical effectiveness if discarded by the dog
for reasons such as inappropriate size, taste, or consistency.

In an effectiveness trial, operators may have two ex-
perimental design options. One design is to select and/or
train dogs for their chewing ability in order to make sure
they would receive the maximum benefit of the device.
Results obtained in this manner would reflect the maximum
effectiveness of the device. This is certainly the best de-
sign when developing effectiveness trials for new devices.
The second design does not train or select dogs with an

Figure 1
Number of dogs (graph plots) chewing the rawhide den-
tal chew < 5 - 10 times during the trial period.

Figure 2
Number of dogs (graph plots) chewing the rawhide den-
tal chew > 15 minutes during the trial period.
<table>
<thead>
<tr>
<th>A</th>
<th>Group</th>
<th>Maxillary Teeth</th>
<th>Mandibular Teeth</th>
<th>All Teeth</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Rawhide Dental Chew</td>
<td>1.51 (0.24)</td>
<td>1.68 (0.23)</td>
<td>1.59 (0.23)</td>
</tr>
<tr>
<td></td>
<td>Control</td>
<td>1.85 (0.18)</td>
<td>2.10 (0.24)</td>
<td>1.96 (0.19)</td>
</tr>
<tr>
<td></td>
<td>Plaque Reduction (%)*</td>
<td>18.0</td>
<td>20.0</td>
<td>19.0</td>
</tr>
</tbody>
</table>

* Treatment group plaque reduction compared with control.

**Figure 3**
Immediate post-trial (day 8) mean (±SD) Silness and Löe Plaque index scores (A and B) for maxillary and mandibular teeth evaluated. Differences in scores between the control and treatment groups are statistically significant.

<table>
<thead>
<tr>
<th>A</th>
<th>Group</th>
<th>Maxillary Teeth</th>
<th>Mandibular Teeth</th>
<th>All Teeth</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Rawhide Dental Chew</td>
<td>3.23 (0.48)</td>
<td>3.62 (0.60)</td>
<td>3.40 (0.48)</td>
</tr>
<tr>
<td></td>
<td>Control</td>
<td>4.02 (0.32)</td>
<td>4.44 (0.40)</td>
<td>4.21 (0.34)</td>
</tr>
<tr>
<td></td>
<td>Plaque Reduction (%)*</td>
<td>19.6</td>
<td>18.4</td>
<td>19.0</td>
</tr>
</tbody>
</table>

* Treatment group plaque reduction compared with control.

**Figure 4**
Immediate post-trial (day 8) mean (±SD) Turesky Index scores (A and B) for maxillary and mandibular teeth evaluated. Differences in scores between the control and treatment groups are statistically significant.
active chewing behavior but only ensures they are not reluctant to chew. This latter design more realistically reflects the clinical situation with client-owned dogs and was chosen in the clinical trial reported here.

Our results do not represent the maximum effectiveness of the rawhide dental chew evaluated in this study but its relative clinical effect in a random group of dogs. Based on the study design used, it is not surprising that dogs were not actively chewing the rawhide dental chew for extended periods during the first days of the study. However, as the study progressed, the frequency and duration of chewing behavior increased in all dogs. A second clinical trial could be performed after a 7-day chew training period in order to test the maximum effectiveness of the device.

Plaque accumulates very rapidly on clean teeth (scaled and polished) when no oral hygiene is practiced. The first week is a period of rapid plaque accumulation. The Silness and Löe plaque index score has been reported to be approximately 2.0 after 14 days. The inhibitory effect of a chew device on plaque reformation can subsequently be assessed during this rapid phase of plaque formation. This type of experimental design has been used commonly in human and animal studies. Plaque scoring in all previous dog studies used an index system which was a modification of the Turesky plaque index. This modified plaque index system has not been validated and may overestimate plaque reduction by using a plaque scoring index which emphasizes the coronal-half of the tooth. In the present study, two original plaque scoring index systems were used which emphasize plaque reduction in the area of the gingival margin. Even though two different plaque index systems were used to assess plaque accumulation in this study, the amount (%) of plaque reduction in the treatment group was similar regardless of which index system was used.

In the past 5-years, different companies have investigated the mechanical removal of plaque through chewing. Feeding a dental hygiene chew once a day resulted in a significant plaque reduction of 14% after 1-week in beagle dogs and after 21-months in a study involving large dogs. However, no reduction in plaque accumulation was reported in other studies at 1 or 3-weeks. Recently, beagle dogs fed a new dental chew were reported to have a significant reduction in plaque accumulation of 29% after 4-weeks. Feeding a dry food specifically formulated for oral care resulted in significant plaque reduction of 19% in beagle dogs after 1-week. The significant plaque reduction of 19% reported here when providing the rawhide dental chew twice a day compares favorably with the results of previous studies.

Conclusion

The specific rawhide dental chew evaluated in this study significantly reduced plaque accumulation in the dog when offered BID. Administration of the rawhide dental chew as reported here may improve oral health. Long-term studies and studies assessing the effect on gingival inflammation would be necessary to better understand the chronic benefit of this rawhide dental chew in the prevention of periodontal disease associated with attachment loss. Finally, not all rawhide dental chews are the same, making clinical trials such as the one reported here mandatory before making a claim of plaque reduction efficacy.

a C.E.T. Dental Chew, Virbac, Fort Worth, TX
b Pedigree Chew Rusk, Kal Kan Foods Inc, Vernon, CA
c Pedigree Rancho, Kal Kan Foods Inc, Vernon, CA
d Prescription Diet Hill’s t/d, Hill’s Pet Nutrition Inc, Topeka, KS

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References