

CANINE PERIODONTAL DISEASE TREATMENT AND PREVENTION

An essay submitted in partial fulfillment of
the requirements for graduation from the

Honors College at the College of Charleston

with a Bachelor of Science in

Biology

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MAY 2016

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Abstract:

The objective of this study is to determine which oral health care products should be recommended for effective at-home treatment and prevention of canine periodontal disease. Six canine oral health products were compared on canine patients of East Cooper Animal Hospital over a 6-week period. Initial and final dental indices of plaque, tartar, gingival severity, and periodontal diseased teeth were determined and compared to determine effectiveness. Tooth brushing showed the most benefits in preventing periodontal infection by reducing plaque build-up, tartar accumulation and gingival redness. Furthermore, all owners that completed the survey followed instructions given by their veterinarians. By understanding owner limitations and clearly explaining the risks of periodontal disease, veterinarians can play a significant role in maintaining a dog's oral health, and could influence whether or not a dog develops dental disease during its lifetime. Additionally, systemic disease development can be prevented with maintenance of good canine oral hygiene on behalf of the veterinarian and the owner.

Introduction:

Similarly to humans, canines must maintain good oral hygiene to prevent bacterial growth, disease, and optimize quality of life; however they must rely on their owners as primary caregivers (Roudebush *et al.*, 2005; Holmstrom *et al.*, 2013). Pet owners can learn the basics of preventing canine dental diseases by listening to and following advice from their veterinarians and clinic staff (Bellows, 2013; Roudebush *et al.*, 2005). At home prevention, as recommended by a veterinarian is an important step in maintaining dental health and preventing further health problems (Roudebush *et al.*, 2005; Holmstrom *et al.*, 2013). The most common preventative measures include tooth brushing, oral health

food, dental chews, water additives, Oratene gel, among others (Becker, 2011). If bacterial growth and disease persist, then veterinarians may also recommend regular dental prophylactic tartar removals in conjunction with a daily treatment plan to maintain oral health (Lindhe *et al.*, 1975).

Among canine oral health care, tooth brushing is shown as the most efficient in reducing the risk of developing dental diseases (Becker, 2011). In addition, dental chews and dental diets are also effective at lowering the risk of dental disease. In one study evaluating the periodontal health in dogs showed that daily dental chews in addition to dry food reduced plaque build-up, tartar accumulation, gingivitis severity, and halitosis (Gorrel *et al.*, 1999). Another study that evaluated the benefits of maintaining a dental diet showed that in comparison with a typical dry food diet the dental diet reduced plaque by 39% and gingivitis by 36% in dogs (Logan *et al.*, 2002). In recent years, food and water additive products have been developed to maintain good oral health; however, few studies exist that evaluate their effectiveness in reducing the development of dental disease.

Canine dental diseases include periodontal disease, gingivitis, halitosis, gingival hyperplasia, oral tumors, and tongue lesions (Bellows, 2013). Of these, the most common is periodontal disease, which is an infection of the gum line due to the accumulation of tartar and plaque that leads to bacterial growth affecting surrounding tissues (DVM, 2013). Studies show that more than 80% of dogs have some stage of periodontal disease specifically by the age of 3 (Marshall *et al.*, 2014). By maintaining good oral hygiene in preventing plaque and tartar accumulation, life span can be lengthened and systemic health problems can be avoided (Hennet, 1999). In one study, periodontitis was shown to

affect systemic health indices such as inflammatory variables, renal indices, blood urea nitrogen (BUN) concentrations, and serum C-reactive protein (CRP) concentrations (Rawlinson *et al.*, 2011). Treatment of canine periodontitis in the subjects led to subsequent positive healing responses throughout their bodies (Rawlinson *et al.*, 2011).

Treatment of periodontitis depends, however, upon the stage of the disease and the degree of gum detachment (DVM, 2013). Stage 1 consists of gum redness and swelling that can be treated with proper cleaning. Stage 2 consists of periodontal pockets, or gum detachments that can be treated by cleaning and applying oral gel to reattach the gum to the tooth. Stage 3 consists of larger periodontal pockets treated with various therapies to reattach the gums. Stage 4 consists of severe bone loss that can only be treated with dental prophylaxis and tooth extraction. It is expected that if owners keep-up with their pet's hygiene using any of the products highlighted previously, then their pets will have a lower risk of developing and suffering from periodontal disease than those that do not maintain oral health (Roudebush *et al.*, 2005). However, some breeds, such as the Toy Poodle and Yorkshire Terrier are more susceptible to periodontal disease than others regardless of whether or not they maintain good oral health. In other situations, owners may not comply with prevention, in which case contracting dental disease may not be avoidable (Becker, 2011).

Since periodontal disease is the most frequently diagnosed disease in adult cats and dogs, it is important to develop and determine the most effective preventative plan for affected patients (Marshall *et al.*, 2014). In this study, six canine oral hygiene products are compared for their ability to reduce infection by periodontal disease on 30 canine patients of East Cooper Animal Hospital in Mt. Pleasant, SC. Plaque, calculus,

and gingival severity were measured as periodontal disease indices. We predicted that if owners were compliant, then tooth brushing would be the most effective treatment plan in reducing periodontal disease indices and overall infection by periodontal disease.

Materials and Methods:

Clinic and Selection

The study took place out of East Cooper Animal Hospital (ECAH) in Mt. Pleasant, SC with the guidance of Dr. Sauls and Dr. Stewart, both practicing small animal veterinarians. Dog owners were selected and asked to participate in the study based on their cooperation with ECAH's clinic policies. Each owner signed a waiver of compliance that informed them of the parameters, risks, and requirements of the study. From these owners, 33 dogs were selected as participants in the study. Independent of oral health, each dog was deemed healthy upon physical examination prior to the start of the study. Any recently performed blood work and urinalysis were also considered. Ages ranged from 1 - 14.5 years and weights ranged from 3.9 - 133.8 lbs. Breeds included large mixed breeds (6), Labrador Retrievers (3), Chihuahuas (3), Pit bulls (3), Great Danes (2), West Highland Terriers (2), Boston Terriers (2), an Australian Blue Heeler, a Belgian Malinois, a Border Collie, a Boykin Spaniel, a Coonhound, a French Bulldog, a Golden Retriever, a Peekapoo, a Pug, a Shepherd, and a Shetland Sheepdog.

Products

A total of six oral health products were tested over a 6-week trial period beginning at the end of January or early February and ending in March. Products tested include: Virbac C.E.T. Dual-Ended Toothbrush and Enzymatic Toothpaste, Oratene Veterinary Drinking Water Additive, Sogeval Clenz A Dent PlaqueOff Food Additive,

C.E.T. VeggieDent Tartar Control Chews, Greenies Veterinary Formula Canine Dental Chews, and Hill's Prescription Diet t/d Canine Original or Small Bites. The Veterinary Oral Health Council (VOHC) recognizes the Virbac Animal Health, Nutro-Greenies, and Hill's Pet Nutrition's oral health products. Oratene and Sogeval's oral health products have not yet been recognized (VOHC, 2016).

Assignments

Patients were randomly assigned to a dental product group before their initial dental assessment. Products were either provided to the owners at this time or within 1 week of the initial dental assessment. Groupings were as follows: Toothbrush and Paste contained 5 dogs (Group 1), Water Additive contained 4 dogs (Group 2), Food Additive contained 4 dogs (Group 3), VeggieDent contained 6 dogs (Group 4), Greenies contained 6 dogs (Group 5), and t/d Food Bites contained 6 dogs (Group 6).

Initial and Final Assessments

During the initial dental assessment, either Dr. Sauls or Dr. Stewart informed owners of the importance of maintaining their pet's oral hygiene. Using The Smile Book IV's plaque, calculus, and gingival indices, each patient's oral health was evaluated. Up to five teeth affected by periodontal disease were indicated, each evaluated separately on a scale of Grade 0 to Grade 4.

During the final dental assessment, owners were thanked for their participation in the study and asked to fill out a final survey. Each pet's oral health was re-evaluated using The Smile Book IV's plaque, calculus, and gingival indices. Plaque was evaluated more in depth using IC-Plaque pink indicator to enable better visibility of plaque

coverage (iM3 Pty Ltd, 2007). The same teeth noted of periodontal disease in the initial evaluation were re-assessed on the same scale of Grade 0 to Grade 4.

All specifications for dental grading can be seen in Table 1. Either Dr. Sauls or Dr. Stewart performed the initial dental assessment. Dr. Samantha Davenport, a veterinary student completing her final externship from Auburn University's College of Veterinary Medicine performed the final dental assessment to control for any biases towards a specific outcome. She was un-informed of the product each participant was assigned.

Testing Period

Group 1 owners were each given one C.E.T. Toothbrush and one tube of C.E.T. Toothpaste. Owners were instructed to brush their pet's teeth once per day for the duration of the study. Groups 2 and 3 owners were each given one container of their assigned product (Oratene Drinking Water Additive or Sogeval Clenz A Dent PlaqueOff Food Additive) and instructed to give two doses of the product total per day to their pet's water or food for the duration of the study. Groups 4 and 5 owners were each given enough dental chews (VeggieDent or Greenies) to last the duration of the study if given once per day. Either Dr. Sauls or Dr. Stewart gave product instructions and informed clients that periodontal disease may develop or worsen if homecare was not followed.

Owner Compliance Survey

When owners returned to the clinic for their dog's final dental evaluation, they were asked to fill out a written participation survey. In addition to name and date, each survey asked seven questions. Questions were as follows: *'Overall do you feel the dental care plan over the last 6 weeks improved your dog's oral health?, What changes (if any)*

did you notice in your dog's oral health? Mark all that apply., Overall did your dog cooperate?, Did you as the owner follow instructions given to you by your vet?, How many times did you accidentally forget or skip treatments?, How realistic was your dog's treatment plan on a scale of 1-5, 1 being "not at all" and 5 being "absolutely"?, Could you see yourself continuing with this treatment plan for your dog's oral health?' At the end of the written survey owners were given a chance to write additional feedback, voice any concerns, or note any additional information not covered by the survey.

Results:

Initial Periodontal Health Status

Eight dogs aged 4 -13 years joined the study with five teeth affected by periodontitis. Five of these dogs were placed in Group 1, one dog in Group 4, and two dogs in Group 5. Six dogs aged 2.5 - 11 years joined the study with four teeth affected by periodontitis. One dog was placed in Group 1, one in Group 2, one in Group 5, and three dogs in Group 6. Six dogs aged 4-12 years joined the study with one – three teeth affected by periodontitis. One dog was placed in Group 2, two dogs in Group 3, one dog in Group 4, one dog in Group 5, and two dogs in Group 6. Eleven dogs aged 1 – 12.5 years joined the study without any teeth affected by periodontitis. Two dogs were placed in Group 2, four dogs in Group 4, two dogs in Group 5, and one in Group 6.

Final Periodontal Health Status

Seven dogs experienced periodontal disease reduction on at least one tooth. Four of these dogs were in Group 1, two dogs were in Group 5, and one dog was in Group 6. Nine dogs experienced periodontal disease worsening on at least one tooth. Two of these

dogs were in Group 2, three dogs were in Group 4, one dog in Group 5, and three dogs in Group 6. Five dogs were unable to return for final evaluation or could not be evaluated.

Relationship Between Dental Treatment Plan and Oral Health

Initial and final plaque, calculus, and gingival grades were averaged for each treatment group. Figure 2 compares the initial and final grading averages for each treatment group. Group 1 exhibited reduction across all periodontal disease indices. Plaque grading increased for Groups 2, 3, 4, 5, and 6. Calculus levels were reduced for Group 2, but were maintained for Groups 3, 4, 5, and 6. Gingival severity decreased for Group 6 and was maintained for Group 3; however, severity increased for Groups 2, 4 and 5.

Owner Compliance and Comments at the End of the Study

Although 32 dogs returned for their final evaluation, only 23 owners completed the final compliance survey. Of the surveys completed, 100% of owners followed all instructions as recommended by their veterinarian. 91% of the owners reported that their dog cooperated during the 6-week period, while 9% reported that their dog did not oblige to the treatment plan. Only 22% of owners reported skipping 4-6 treatments, while 48% skipped 1-3 treatments. 52% of owners felt that their pet's oral health improved minimally, while 22% reported 'no change'. The other 26% of owners reported 'significantly noticeable change'. As seen in Figure 1, when asked 'What changes (if any) did you notice in your dog's oral health?' 47% of owners reported fresher breath. 'Decreased plaque', 'decreased tartar', 'decreased gum redness', and 'overall cleaner teeth' were each reported by 4 owners (11%). 3 owners (8%) did not notice any changes.

In response to '*How realistic is this treatment plan?*' 18 owners reported that they could see themselves continuing with this plan.

Discussion:

In comparison with previous studies and oral health product advertisements, the results from this study on tooth brushing were the only consistent findings. Enzymatic Toothpaste with the C.E.T. Dual-Ended Toothbrush is advertised to neutralize halitosis while previous studies on canines have shown reduction of plaque, tartar, and gingival redness (Virbac, nd.). The results on tooth brushing agree with these statements. Hill's Prescription Diet t/d clinical nutrition has been clinically proven to reduce plaque and tartar accumulation; however, the present study suggests that t/d food increases plaque (Hill's, nd). It would be beneficial to do a comparative case study at East Cooper Animal Hospital combining both of these treatment plans to determine whether periodontal disease is more effectively reduced in conjunction with one another.

The Greenies Veterinary Formula Canine Dental Chews are advertised to effectively reduce plaque and tartar accumulation with their chewy texture (The Nutro Company, 2012). Similarly, the C.E.T. VeggieDent Tartar Control Chews are advertised for their chewable, z-shaped design and have been shown to reduce plaque, tartar, and decrease halitosis (Clarke, 2011; Virbac Corp., 2009). Upon comparison with periodontal health indices, this study shows that VeggieDent and Greenies dental chews behave similarly by reducing plaque accumulation, decreased gingivitis, and maintaining calculus. However, when comparing the number of diseased teeth reduced or worsened between the two treatment groups, Greenies dental chews reduced more diseased teeth than did VeggieDents. For example, all four diseased teeth in a 7-year-old Golden

Retriever were reduced from periodontal disease Grade 2 to Grade 0 with the use of Greenies Veterinary Formula.

C.E.T. Oratene Veterinary Drinking Water Additive is advertised to remove plaque biofilm and reduce halitosis (PKB, 2009). In contrast, the present study shows accumulation of plaque over the 6-week period. Owners using the water additive, however, did notice fresher breath which remains consistent with advertisements. Similarly, Clenz A Dent PlaqueOff Food Additive is advertised as a natural oral health product that contains seaweed, *Ascophyllum nodosum*, which decreases tartar and halitosis (Entirely Pets, 1999). Since two out of the four patients in the food additive group were unable to complete the study, results from this group are likely unrepresentative of most cases and should not be compared with advertisements, previous studies, or other treatment groups. In an additional study, it is suspected that these oral health products behave similarly, yet they do not promote reduction of periodontal disease development.

Inconsistencies of this study in comparison with prior studies and advertisements could be due to the small sample sizes of each treatment group, especially for the food additive and water additive groups. In any subsequent studies, sample sizes for each treatment should be increased and the sizes of each group should be equal for fair comparisons.

One variable not controlled in this study was diet. All owners were recommended by the prescribing veterinarian to continue their dog's regular food regimen at home; however, one owner was advised by Dr. Sauls to reduce caloric intake for dietary reasons. The role that diet plays in the development of periodontal disease remains

unclear, and further research should be conducted to determine this association (Watson, 1994). In the meantime, it is recommended that veterinarians and dog owners should pay attention to the textural qualities of food, as well as nutritional qualities, to limit plaque and tartar accumulation (Watson, 1994). In an additional study, either food should be standardized across all patients or dietary habits should be noted for all patients. This could give insight on whether confounding variables are interacting with periodontal disease reductions.

Conclusion:

Although homecare is extremely important, the first and most crucial step is client communication to educate owners on the risks of canine periodontal disease. All veterinary clinic staff should participate in this client education (Bellows, 2013). As dog owners become better informed, the more precautions they are likely to take in maintaining their dog's oral health (Becker, 2011). In addition, it is important for veterinarians to know their clients, their financial situations, and their physical abilities to properly guide them on maintaining their dog's health (Holmstrom *et al.*, 2013). Some dog owner's are elderly or have temperamental dogs, which makes it almost physically impossible to brush teeth. In this case it would be wise to recommend an oral care diet, dental chew, or dental additive. In contrast, however, if a dog owner is willing to brush their dog's teeth and the dog will cooperate, then tooth brushing should be recommended first over other oral health products. Additionally, veterinarians and clinic staff should always properly explain or demonstrate preventative techniques for any owners who do not know how to brush their dog's teeth or apply oral gel.

As displayed in this study, understanding owner limitations and clearly explaining the risks of periodontal disease can play a significant role in maintaining a dog's oral health, and could influence whether or not a dog develops dental disease during its lifetime. With increased emphasis on canine oral health maintenance in client education, veterinarians and clinic staff can reduce the risk of dog's developing periodontal disease as well as other subsequent systemic diseases.

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Tables and Figures:

Index	Grade 0	Grade 1	Grade 2	Grade 3	Grade 4
Plaque	None	< 1/3 covered	1/3 - 2/3 covered	> 2/3 covered	
Calculus	None	< 1/3 covered	1/3 - 2/3 covered	> 2/3 covered	
Gingivitis	Healthy with no inflammation	Minimal inflammation; no bleeding	Wide band of inflammation; bleeding	Advanced inflammation; ulceration	
Periodontal Disease	Healthy; no inflammation or attachment loss	Gingivitis only; no attachment loss	0-25% attachment loss	25-50% attachment loss	> 50% attachment loss

Table 1: Guidelines for Dental Grading Provided by The Smile Book IV. Plaque, calculus, and gingival grades were determined first based on the entire mouth, and then individual periodontal diseased teeth were evaluated. Plaque coverage refers to the amount of staining or plaque accumulation. Calculus coverage refers to the amount of visible tartar. Gingivitis refers to the amount of gingival inflammation or observable bleeding upon probing. For plaque, calculus, and gingival indices, if more than 50% of the mouth was observed at a certain grade, then that grade was indicated. Periodontal disease grades combine gingivitis with attachment loss as observable on any affected teeth (Bellows, 2005).

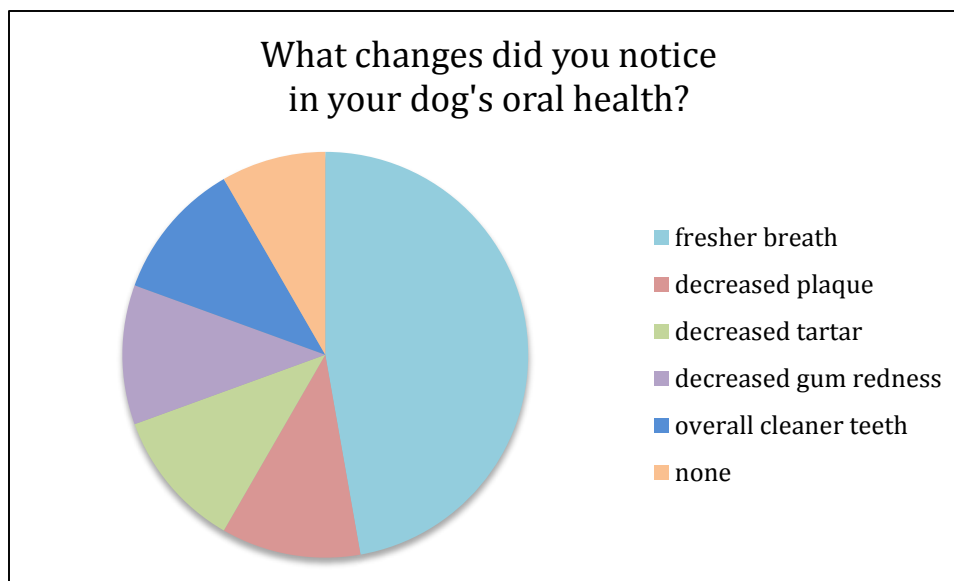


Figure 1: Owner Compliance Survey Responses. Percentages based off a total of 23 owners that completed the final survey. Fresher breath (light blue) represents 47% of total responses. Decreased plaque (red), decreased tartar (green), decreased gum redness (purple), and overall cleaner teeth (blue) each represent 11% of total responses. None (orange) represents 8% of total responses.

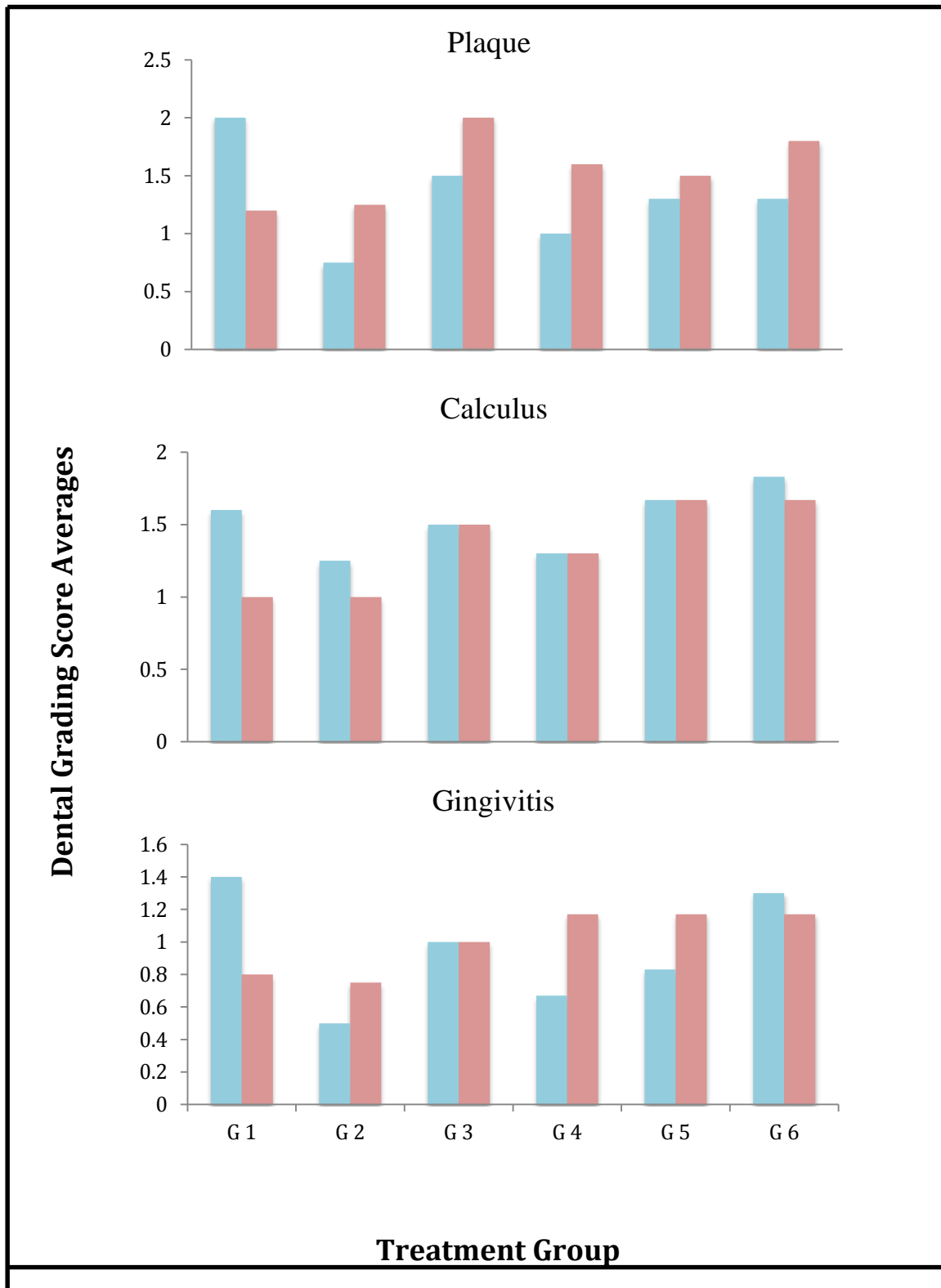


Figure 2: Periodontal Disease Indices. Averages and graphs were created on Excel. Blue indicates initial grading averages and red indicates final grading averages. "G 1-6" denotes Groups 1-6.