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Investigation of Bacteremia After Orthodontic Banding and Debanding Following Chlorhexidine Mouth Wash Application

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ABSTRACT

This study investigates the prevalence of bacteremia after orthodontic banding and debanding, following the application of a 0.2% chlorhexidine gluconate mouthwash. The banding and debanding groups were each composed of 40 young adult patients. In the banding group, patients were asked to rinse their mouth with chlorhexidine gluconate for 60 seconds just prior to fitting of the bands. In the debanding group, they were asked to use the mouthwash immediately before removal of bands and brackets. In both groups pre- and post-treatment blood samples were obtained with a strict aseptic technique. In the banding group, no bacteremia was detected in the pretreatment sample and 2.5% post-treatment bacteremia was detected in the post-treatment sample. In the debanding group, 2.5% bacteremia was found in both the pre- and post-treatment samples. The prevalence of post-treatment bacteremia found in the present study were compared with the findings of 2 preliminary studies in which the prevalence of bacteremia had been investigated after banding and debanding without a prior application of chlorhexidine mouthwash. The application of chlorhexidine mouthwash resulted in a decrease in the prevalence of bacteremia after banding and debanding, but the decrease was not statistically significant.

KEY WORDS: Bacteremia, Orthodontic banding, Orthodontic debanding, Chlorhexidine gluconate.

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INTRODUCTION Return to TOC

Transient bacteremia may occur following various dental procedures including extraction, periodontal therapy, endodontic therapy, and some orthodontic manipulations.[1–10] It lasts about 10 to 30 minutes and is usually considered of little significance except in patients with congenital or acquired cardiovascular system diseases who are at high risk of infective endocarditis.[11–12]

Transient bacteremia following orthodontic procedures has been shown in clinical investigations. In a study on 10 patients, Degling[7] has shown no bacteremia after the placement and removal of orthodontic bands. McLaughlin et al,[8] on the other hand, reported a bacteremia prevalence of 10% after banding. In 2 studies prior to the present study, Erverdi et al[9,10] found bacteremia prevalences of 7.5% and 6.6%

following banding and debanding procedures, respectively. Looking at these findings, the incidence of bacteremic episodes from orthodontic banding or debanding seems to be much lower than that resulting from mastication (17% to 51%) and oral hygiene procedures such as toothbrushing (0% to 26%) and dental flossing (20% to 58%).[13]

Guidelines from the American Heart Association recommend antibiotic prophylaxis during the initial placement of orthodontic bands in patients at risk of infection.[14] However, the clinicians should also consider that antibiotic use may have undesirable effects such as blood disorders, hypersensivity, gastrointestinal problems, bacterial resistance, and interactions with other drugs.[15] Morever, the protective efficacy of antibiotic prophylaxis is not yet fully established. According to Strom et al,[16] even if 100% effectiveness was assumed, only a few cases of infective endocarditis would be prevented by antibiotic cover for dental procedures.

In addition to systemic antibiotic prophylaxis, antiseptic mouthwashes applied immediately before dental procedures may reduce the incidence and severity of bacteremia.[17–18] Among agents like chloramine-T, povidone-iodine, iodine, and glycerin, chlorhexidine is the topical antiseptic of choice. The usual procedure is oral rinsing with chlorhexidine for 1 to 2 minutes prior to the dental procedure, after the systemic antibiotics have reached sufficient blood levels.[13] Initially used as an antiseptic cream for skin wounds, chlorhexidine gluconate was introduced as a mouthwash by Löe and Schiot in 1970.[19] For the past 3 decades, many studies have substantiated the beneficial effects of chlorhexidine in plaque control.[19–23] Chlorhexidine mouthwash is commercially available in 0.12% and 0.2% concentrations. Similar results have been obtained with the 2 chlorhexidine concentrations with regard to reduction of plaque accumulation and gingival inflammation.[24,25] The mechanism of action of a chlorhexidine mouthwash seems to be an immediate and probably short-lived bacteriocidal effect followed by a prolonged bacteriostatic action dependent on antiseptic absorbed by the pellicle coated tooth surface.[26] Considering the drawbacks of antibiotic use, the use of chlorhexidine alone may be justifiable when performing procedures with a low incidence and low grade of bacteremia in low-risk patients.

The aim of the present study was to evaluate the prevalence of bacteremia following orthodontic banding and debanding procedures after the application of a 0.2% chlorhexidine gluconate mouthwash.

MATERIALS AND METHODS Return to TOC

This study was carried out in 2 groups of patients. In the first group, bacteremia was measured after banding procedures. In the second group, bacteremia was measured after debanding and debonding procedures. Both groups were comprised of 40 patients. The banding group included 16 male and 24 female patients. The debanding group included 12 male and 28 female patients. Average ages of the patients in the 2 groups were 17.4 and 18.6 years, respectively. Oral hygiene status of the patients was determined on a separate occasion before initiating the experimental procedures. Only those individuals with a plaque index $\leq$ 2 and gingival index $\leq$ 1 were included in the study group.[27]

In the debanding group, all of the selected patients were treated with a multibracket system, with bands on first molars and direct bonding attachments on the other teeth. Patients with a congenital or acquired heart disease, a history of rheumatic fever or some other medically compromised situation were excluded from the study group. A detailed list of patient inclusion and exclusion criteria can be seen elsewhere.[10] For ethical requirements, all procedures were explained to the patients and an informed consent form was signed by each individual. The patients were instructed not to brush their teeth for 2 hours before their banding or debanding appointment.

In the banding group, brass wire separators were placed at the mesial and distal contacts of 1 upper first permanent molar in each patient. The patients were called back after 1 day for band selection. After adjustment of the band with the routine method, the selected band was removed and brass wire separators were placed again. This time the separators stayed in place for 7 days. On the day of the banding appointment, just before the removal of the separators, a blood sample of 11 mL was obtained from an antecubital vein using a strict aseptic technique. The patient was asked to rinse his or her mouth for 60 seconds with 15 mL of 0.2% chlorhexidine gluconate mouthwash (Klorhex, Drogsan, Ankara, Turkey). Then, after removing the separators, the previously selected band, which was sterilized prior to the operation, was cemented with light-cured glass ionomer cement. Immediately after cementing the band, a second blood sample of 11 mL was drawn into a new sterile syringe.

In the debanding group, before removal of bands and brackets, an 11 mL blood sample was obtained from an antecubital vein following a strict aseptic technique. The patient then rinsed his/her mouth for 60 seconds with chlorhexidine mouthwash. Immediately after removal of all bands and brackets (before cleaning the residual cement and bonding material on tooth surfaces), a second blood sample of 11 mL was obtained. The subjects in both groups were examined for the presence of bleeding during band adjustment or appliance removal.

Pre- and post-treatment blood samples from both banding and debanding groups were microbiologically evaluated. Ten mL of pre- and post-treatment blood samples were aseptically inoculated into blood culture bottles (Signal Blood Culture System, Oxoid Unipath Limited, Hampshire, England) that were connected with a growth indicator device and incubated at 37° for 14 days. Positive results were indicated in the bottles in which the blood and broth mixture had risen above the green locking sleeve of the growth indicator device. Cultures were taken from positive bottles and plated on agar and blood agar supplemented with 0.0005% hemin (Sigma Chemical Co, St Louis, Mo) and 0.00005% menadione (Sigma). These were incubated under aerobic and anaerobic conditions, respectively. Colony morphology, gram-staining procedures, standard microbiologic biochemical testing technique, and API 20 strips (bioMerieux, Marcy l'Etoile, France) identified

the bacterial colonies. In addition to the Signal blood culture test, the number of bacteria per mL of blood was determined by the pour-plate method that used 20 mL of fastidious anaerobic agar (Oxoid) supplemented with 5% calf serum. Colonies from the pour plate were counted and identified using this procedure.

The prevalence of bacteremia before and after treatment was statistically analyzed in both groups. The post-treatment prevalence of bacteremia found in the present study were compared with the findings of 2 preliminary studies in which bacteremia had been investigated after banding and debanding without a prior application of chlorhexidine mouthwash.[9–10] A *T*-test for testing the difference between 2 independent proportions was used in the statistical analysis of the findings.[28]

RESULTS Return to TOC

The microbiologic findings of the present study can be seen in Tables 1 and 2. In the banding group, no pretreatment bacteremia was found. On the other hand, post-treatment bacteremia was found in one patient (2.5%) by both Signal blood culture and pour plate methods. The microorganism isolated from the post-treatment blood sample was *Bacteroides oralis* with 4 colony forming units per mL of blood (CFU/mL).

In the debanding group, pretreatment bacteremia was found in 1 patient (2.5%) by Signal blood culture while pour-plate method detected no bacteria. *Staphylococcus aureus* was the species identified in the pretreatment blood sample. Bacteremia was detected in the post-treatment blood sample of another patient (2.5%) by both methods. *Streptococcus sanguis* I-2 was identified as the causative agent with a quantity of 2 CFU/mL.

In both groups, there was no statistically significant difference between the pre- and post-treatment blood samples with respect to percentage of bacteremia ($P > .05$). The post-treatment bacteremia prevalence of 2.5% found in the banding group in the present study was compared with the 7.5% bacteremia found in the preliminary study in which no chlorhexidine had been used prior to banding. There was no statistically significant difference between the 2 proportions ($P > .05$). Comparison of 2.5% bacteremia found in the debanding group in the present study with 6.6% bacteremia detected in the other preliminary study in which no chlorhexidine had been used prior to debanding also showed no significant difference between the 2 proportions ($P > .05$). Gingival bleeding was detected in 16 patients in the banding group and 15 patients in the debanding group.

DISCUSSION Return to TOC

The present study is the third in a series of 3 studies related to bacteremia and orthodontic procedures.[9–10] In the first 2 studies the prevalence of bacteremia after orthodontic banding and debanding were investigated because, among all orthodontic procedures, these 2 procedures are considered to cause the greatest damage to the gingiva. In this study, the prevalence of bacteremia after banding and debanding following the application of chlorhexidine mouthwash were assessed. All 3 studies had similar sample sizes and patient characteristics. During the course of the investigations, the same clinical and microbiological methods were followed so that direct comparisons could be made.

Bacteremia induced by *Staphylococcus aureus* was detected by Signal blood culture in one of the pretreatment blood samples from the debanding group; however, the presence of this bacteremia was not confirmed by the pour-plate method. An explanation for this discrepancy could be that the amount of blood used in the pour-plate method was only 1 mL compared to the 10 mL used in the Signal blood culture.

The incidences of bacteremia associated with orthodontic banding and debanding were found to be lower than the incidences reported for bacteremia associated with normal daily living (chewing, brushing, flossing).[13] Cases of bacteremia associated with these orthodontic procedures seem to be low grade with 1 to 23 bacterial colonies per mL of blood, compared with 10^3 to 10^9 bacterial colonies per mL of blood necessary to induce experimental infective endocarditis.[8–,13] It was claimed that dental treatment-induced bacteremias were responsible for about 15% of infective endocarditis cases.[29] Only 4 cases of endocarditis associated with orthodontic treatment have been identified in the literature.[30–32] None of these cases were associated with banding or debanding, but with minor adjustments for which the American Heart Association recommends no antibiotic prophylaxis.

There are conflicting views with regard to the efficacy of antibiotic prophylaxis for the prevention of infective endocarditis.[33–36] The efficacy of antibiotic prophylaxis has not been determined in controlled human clinical trials.[13] According to Strom et al,[16] few cases of infective endocarditis could be prevented with antibiotic prophylaxis even with 100% effectiveness assumed. Antibiotic prophylaxis may cause resistance in pathogens, allergic and toxic reactions as well as interactions with other drugs. A satisfactory risk-benefit ratio should be established when prescribing antibiotic prophylaxis.

Given these considerations, clinicians may feel the need to reexamine the protocols for administering antibiotic prophylaxis before dental procedures. There is no doubt that antibiotic coverage should be instituted for patients at high risk for endocarditis. For low- to no-risk patients, less invasive prophylactic measures may be a better choice—especially for procedures that are associated with a low incidence

of bacteremia. In these cases, the use of a chlorhexidine mouthwash before orthodontic banding and debanding may be appropriate. There is evidence in the literature that antiseptic mouthwashes applied prior to dental manipulations may reduce the incidence and severity of bacteremia.[17–18] However, the effectiveness of chlorhexidine gluconate mouthwash in reducing bacteremia associated with orthodontic banding and debanding was not confirmed in the present study. Though the bacteremia prevalences found with chlorhexidine application were smaller than the prevalences obtained without chlorhexidine, the differences were not statistically significant. Studies conducted on larger samples are necessary in order to reach a definite conclusion.

CONCLUSION Return to TOC

A 2.5% prevalence of bacteremia was present following both orthodontic banding and debanding that had been immediately preceded by the application of a chlorhexidine gluconate mouthwash. This prevalence of bacteremia did not show a significant difference whether it was performed with or without a prior chlorhexidine application.

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TABLE 1. Blood Culture Results for the Preoperative and Postoperative Samples in Both Groups[a]

Blood Sample	Banding Group (n = 40)		Debanding Group (n = 40)	
	Signal Blood Culture	Pour Plate	Signal Blood Culture	Pour Plate
Preoperative	—	—	1	—
Postoperative	1	1	1	1

[a] n indicates number of patients.

TABLE 2. Microorganisms Isolated from Preoperative and Postoperative Blood Samples in Both Groups[a]

Blood Sample	Banding Group		Debanding Group	
	Species	CFU/mL	Species	CFU/mL
Preoperative	—	—	*Staphylococcus aureus*	—
Postoperative	*Bacteroides oralis*	4	Streptococcus sanguis I-2	2

[a] n indicates number of patients; CFU/mL, colony forming unit per millimeter of cultured blood.

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