Effect of Achromycin Ointment on Healing Following Periodontal Surgery

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Accepted for publication 14 August 1982

THIS STUDY EVALUATED the effect of applying 3% Achromycin on healing following periodontal surgery. Twelve patients participated, and 15 contralateral sides with similar disease were compared. The parameters assessed included amounts of gingival crevice fluid quantitated with the Periotron, gingival bleeding tendencies, mobility scores and attachment levels. No significant differences in bleeding tendency, mobility or attachment levels were found. Significant changes were noted on amounts of gingival crevicular fluid, however. The amounts of gingival crevicular fluid collected were significantly lower on the side not treated with Achromycin throughout the observation period. Applying 3% Achromycin did not have a beneficial effect on the healing of periodontal wounds. Whether the application of an antibiotic on sutured flaps limited the bacterial contamination of the gingival tissues through a "wicking effect" of the silk suture material, or if this bacterial contamination had any consequence on gingival healing or reattachment of the periodontal tissues adjacent to the tooth, cannot be determined from this study.

Previous studies using chemical and mechanical means of plaque control have shown that a "plaque-free" surgical site allowed for optimal wound healing.[1-11] Achromycin‡ ointment has been recommended to minimize the possibilities of tissue contamination by bacteria adjacent to wound margins and/or suture material, and to prevent the sutures from adhering to the dressing.[12] The purpose of this study was to determine whether this practice enhances clinical healing following periodontal flap surgery.

MATERIALS AND METHODS

Subjects for the study included 12 adult patients, nine men and three women with a mean age of 41 years, attending the University of Michigan School of Dentistry for periodontal treatment. Patients were free from systemic diseases, not pregnant, taking no medications and not allergic to tetracycline or its derivatives. All patients exhibited mild to moderate periodontitis with similar degrees of inflammation and bone loss on either side of the maxillary or the mandibular arch.

Evaluation Criteria. Assessment criteria included measuring crevicular fluid flow and clinical attachment levels, and recording bleeding tendency and mobility. The gingival crevicular fluid flow was assessed using the Periotron.§ The area was isolated with cotton rolls and dried with warm compressed air. A filter strip was placed into the sulcus until "minimal resistance" was felt. After 3 seconds it was removed, and a period of 27 seconds elapsed before another strip was placed for 3 seconds. This strip was then placed between the jaws of the Periotron and the value registered was recorded.

The level of clinical attachment was determined using the cementoenamel junction as a fixed reference point.[13] All measurements were taken with a CP-11 periodontal probe.‖ Measurements were taken at two locations on the facial aspect of the tooth: (1) at the midline of the tooth (for the molars, at the midline of the mesial-buccal root), and (2) at the mesial interproximal surface at the contact point. Measurements recorded were (1) the distance from the cementoenamel junction to the gingival margin, and (2) the crevice or pocket depth. All measurements were rounded to the nearest millimeter. From these two measurements the level of clinical attachment was determined.

The Gingival Bleeding Index[14] identified the presence or absence of gingival inflammation as determined by bleeding from the interproximal gingival sulci. Unwaxed

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dental floss was placed at the bottom of the mesial gingival sulci. The floss was then moved in an occlusogingival motion for one double stroke. After 30 seconds each segment was reassessed for the presence or absence of bleeding.

The Mobility Index[15] was used to assess the degree of tooth mobility. The examiner used two blunt-ended instruments to determine the degree of mobility. It was graded from 0 to 3.

Experimental Procedure. Prior to surgical treatment, the hygienic phase of the treatment was completed, which included emergency treatment, oral hygiene instruction, correcting overhanging restorations, scaling, root planing and polishing, as well as adjusting any teeth with signs of trauma from occlusion.

The experimental units included second bicuspids and first molars of contralateral quadrants. Students enrolled in the graduate program of periodontics performed the surgical procedures with the same operator treating both quadrants. Before local anesthesia was administered, a presurgical measurement of the crevicular fluid from the buccal and mesiobuccal sulci of the appropriate teeth was performed by the investigator. Then the investigator scored the bleeding index, measured mobility and recorded pocket depths and clinical attachment levels for the teeth. The criteria of the modified Widman flap was followed for all procedures.[16] Interrupted 4-0 silk sutures were used to secure the properly-adapted flaps. The flaps were held in place for approximately 2 to 3 minutes to allow the initial hemostasis and fibrinization of the wound surfaces. At this stage, the operator either applied the 3% Achromycin ointment with "dry-foil" on the surfaces of the wound (experimental side) or placed "dry-foil" over the suture material (control side). This experimental quadrant was selected randomly by the toss of a coin. Surgical dressing (Coe-Pak) protected all the wound sites. In order to assure a blind evaluation, the investigator was unaware of the code until the completion of the study.

At the 1-week postsurgical visit, dressings and sutures were removed. Afterwards, the patients were seen for polishing once a week for 4 weeks. This postoperative care was performed by the same operator responsible for the surgery. The investigator recorded measurements of the amount of crevicular fluid flow, which were obtained before polishing, during the 2- and the 4-week postsurgical visits. At 4 weeks, all parameters analyzed were rescored and the values were recorded. Clinical attachment levels were also recorded after an average time of 8 to 9 months.

Paired *t* tests were used to compare the differences obtained at different time intervals between the test and control sides as far as crevicular fluid flow and attachment levels. Changes in mobility and in bleeding tendency were analyzed with descriptive statistics. Differences were considered significant at the *P* value of 0.05.

Examiner's Reproducibility. Before proceeding with the study, calibration of the examiner was determined by measuring clinical attachment levels in triplicate for four patients. Patients included two pretreatment cases and two post-treatment maintenance cases and the teeth scored included No. 3, 6, 13, 19, 25, 29. Six measurements for each tooth were made.

The mean square error, or variance, was 0.2956 and was determined by using an analysis of variance computation. This means that for each clinical attachment level recording one might expect a variability of ± 0.55 mm (SD). Repeated mobility scores had a variance of 0.06389 or a deviation of ± 0.25 from the Mobility Index scores.

RESULTS

Experimental Results. A comparison between the amounts of gingival crevicular fluid (GCF) collected from the mesial and buccal sulci on the side treated with 3% Achromycin and that from the sulci of the control side over various time intervals is presented in Table 1 and Figure 1. At the initial 2-week observation period, the mean value for the mesial GCF flow on the experimental side increased by 4.2 units; while the mean value of the GCF flow for the control mesial surfaces decreased by 2.97 units. By using the paired *t* test to compare these experimental and control mean value changes from baseline, a statistically significant difference ($P = 0.004$) was demonstrated between the contralateral sides. The buccal sulci did not demonstrate any significant differences

Table 1
Mean Differences in Gingival Crevicular Fluid at Different Observation Periods (Paired t test)

GCF	Baseline	Sign.	2 Weeks	Diff.*	Sign.	4 Weeks	Diff.*	Sign.
Mesial								
Experiment	10.13	0.04	14.33	4.20	0.0042	8.03	−2.10	N.S. (0.09)
Control	15.10		12.13	−2.97		8.25	−6.80	
Buccal								
Experiment	3.23	N.S.	5.00	1.77	N.S.	2.97	−0.27	N.S. (0.06)
Control	4.80		5.10	0.30		2.20	−2.6	
Totals								
Experiment	6.68		9.67	2.99	0.02	5.50	−1.18	0.03
Control	9.95		8.62	−1.32		5.23	−4.72	

* From baseline.
− Indicates less GCF from baseline.

during this initial observation period, with both sides exhibiting an increased GCF flow. At 4 weeks postsurgery, both the mesial and buccal sulci displayed no statistically significant differences although the *P* values for the mesial and buccal sulci were 0.09 and 0.06, respectively. Comparing mean mesial and buccal values between the experimental side and control side in Table 1, a greater decrease in GCF flow from the baseline could be seen for the control side and this greater amount accounted for the significance. Figure 1 graphically shows the changes in GCF flow for the experimental and control sides over the two observation periods. Combining all GCF values recorded from the sulci exposed to Achromycin and comparing these mean changes to those of the control sulci, a statistically significant decrease in GCF flow for the control side could be seen for both observation periods. Finally, all sulci during the postsurgical observation periods demonstrated lower amounts of GCF as compared to the baseline values and achieved similar levels of GCF at the 4-week postsurgical period (Table 1).

Examination of the changes related to loss of clinical attachment for the teeth exposed to Achromycin exhibited no statistically significant difference when compared to the changes in clinical attachment level of the control teeth over all observation periods (Table 2 and Fig. 2). Mean mesial and buccal clinical attachment levels were similar at the final observation period between contralateral sides.

Descriptive statistics were used to analyze any effect the Achromycin could have on bleeding tendency or mobility (Tables 3 and 4). No significant differences were evident. Due to the minimal changes between groups, low number of patients and the insensitivity of the Gingival Bleeding Index,[14] no correlations can be made between the bleeding tendency and the changes in GCF.

DISCUSSION

Topical use of antibiotics has not been viewed favor-

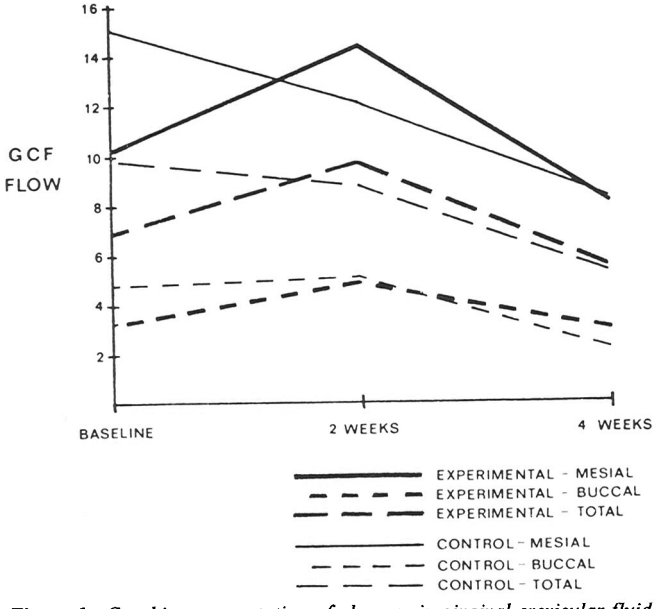

Figure 1. *Graphic representation of changes in gingival crevicular fluid over time, for experimental and control areas.*

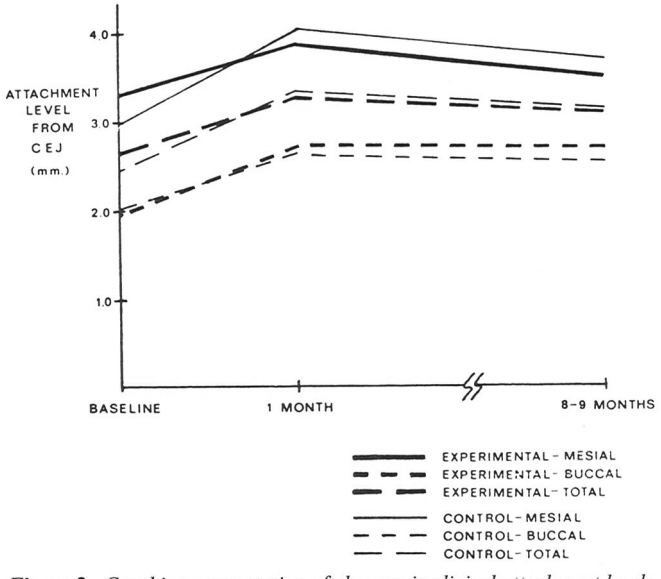

Figure 2. *Graphic representation of changes in clinical attachment levels over time, for experimental and control areas.*

Table 2
Mean Differences in Attachment Level* at Different Observation Periods (Paired t test)

	Baseline	Sign.	Month	Diff.	Sign.	Approximately 8–9 Months	Diff.	Sign.
Mesial								
Experiment	3.30	N.S.	3.87	−0.57	N.S.	3.50	−0.20	N.S.
Control	2.97		4.07	−1.10		3.70	−0.73	
Buccal								
Experiment	1.97	N.S.	2.73	−0.76	N.S.	2.70	−0.73	N.S.
Control	2.00		2.67	−0.67		2.53	−0.53	
Totals								
Experiment	2.64	N.S.	3.30	−0.66	N.S.	3.10	−0.46	N.S.
Control	2.49		3.37	−0.88		3.12	−0.63	

* Measured in millimeters from CEJ.
– Denotes loss of attachment from baseline.

Table 3
Frequency Distribution According to Bleeding Tendency at Baseline and 4 Weeks

	Baseline		4 Weeks	
	No.	%	No.	%
Present				
Experimental	3	5	2	3
Control	2	3	4	7
Absent				
Experimental	27	45	28	47
Control	28	47	26	43

Table 4
Frequency Distribution According to Degrees of Mobility at Baseline and 4 Weeks

	Baseline		4 Weeks	
	No.	%	No.	%
MI 0				
Experimental	15	25	9	15
Control	15	25	11	18
MI 1				
Experimental	13	22	17	28
Control	14	23	17	28
MI 2				
Experimental	2	3	4	7
Control	1	2	1	2
MI 3				
Experimental	0	0	0	0
Control	0	0	1	2

ably in recent times. Concern over sensitization of the patient, development of resistant strains of bacteria and a lack of proven effectiveness have been the primary reasons.[17] One must question the wide discrepancy in the frequency of using topical antibiotics between medicine and dentistry.

The medical literature abounds in documentation advocating topical antibiotics for reducing the incidence of infection and providing for optimal healing. However, much of the evidence consists of clinical impressions, case reports, studies without controls or poorly-designed experiments.

Dental practitioners have admonished the use of topical antibiotics on circumstantial evidence presented primarily in two articles. Fraleigh[18] contended that tetracycline incorporated in dressings after periodontal surgery resulted in "allergic" reactions in 11 patients. Upon reapplication of tetracycline, either systemically or topically, only one patient demonstrated a recurrence of the reaction. Fraleigh went on to report that 98% of the patients receiving terramycin packs demonstrated more rapid healing, more comfort and less of an odor or bad taste.

The other article cited as evidence against using topical antibiotics is Ramanow's[19] use of tetracycline-incorporated dressings after periodontal surgery. These patients did not experience allergic reactions; however, his findings indicated that 12 to 14% of the patients developed angular cheilitis and sore tongue, signs and symptoms he attributed to an overgrowth of *Candida albicans*. These dressings were usually left in place for a minimum of 2 weeks; therefore, an altered oral flora could have permitted an overgrowth of *C. albicans*. In untreated mouths, Romanov cultured yeast organisms in 15% of the sampled subjects. The author's warnings, contraindicating the use of these drugs, have been effective in limiting their usage. Although only a few articles have utilized an antibiotic in a topical application, no other reports of allergic reactions could be found.

Concerning the present investigation, statistically significant differences were found in GCF flow when the mesial and buccal sulci of the teeth treated with Achromycin were compared to the contralateral control sulci. At the first observation period, the mean mesial GCF flow values of the controls demonstrated a decrease from the baseline value, while the Achromycin-treated sulci exhibited an increased GCF flow (Fig. 1). At the 4-week observation period, the mean mesial and buccal GCF flow values for the contralateral sides were similar; however, a near statistical significant difference was reported since the controls demonstrated a greater reduction in GCF as compared to that of the baseline values.

Carrel,[20] Geronemus et al.[21] and Eaglstein and Mertz[22] noted the importance of the wound environment and the effect of various agents on the healing process.[17] Antimicrobial products, including their vehicles, can either enhance or inhibit wound healing. Although tetracycline derivatives were not tested in these studies, it is known that tetracycline has the property of inhibiting protein synthesis and could have been instrumental in adversely affecting the process of healing of the gingival tissues to the teeth.[23, 24]

Also, Eaglstein and Mertz[22] reported that the vehicles by which the antibiotics were transported could also affect the rate of healing. Petrolatum decreased the re-epithelialization process in the animals tested. Ophthalmic 3% Achromycin ointment contains 87% white petrolatum (weight volume), 10% white lanolin and 3% tetracycline. Both the tetracycline and petrolatum when applied to the periodontal wound surfaces theoretically could act to reduce the healing capacity of the gingival tissues.

Probing was used to score any change in clinical attachment level. Although probing pressure could have affected the results, especially short-term, where tissue maturation has not yet been achieved following surgery, the consistency of results and the fact that probing was always performed by the same calibrated operator lends validity to the present findings.

The Gingival Bleeding Index[14] determined the presence or absence of bleeding following insertion of dental floss into the sulcus. Shortcomings could have affected the results. First, the floss might have never reached the depth of the pocket, and second, the minute changes in the healing tissues might not be elucidated by this gross observation. Also, the frequence of improvements was

small, since a high percentage of areas did not show bleeding at baseline. For these reasons, it was not appropriate to attempt a correlation between the bleeding tendency and the changes in the flow of GCF. Similar criticisms apply to the mobility results; that is, the changes are too subtle to report a difference concerning the drug application.

The results of this study corroborate the reports from recent studies in the medical literature concerning the effect of antimicrobial agents and their vehicles on wound healing.[21, 22] Although the parameters used in this study were not sensitive enough, the greater amount in GCF flow from the experimental sulci implies that the drug had a slight detrimental effect on the healing of the periodontal wounds. The data from this study *would not* serve as justification for using an antibiotic topically, even if one believes that a "wicking effect" of the suture material may have significance in the healing or reattachment of periodontal surgical wounds. Furthermore, the inherent histologic architecture of the gingiva, consisting of dense collagen and low vascular reactivity, may act as a limiting factor to the harm caused by bacteria along the silk suture material after flap adaptation.[25, 26] Whether the application of an antibiotic on sutured flaps limited the bacterial contamination of the gingival tissues through the "wicking effect" of the silk suture material, or if this bacterial contamination had any detrimental consequence on gingival healing or reattachment of the periodontal tissues adjacent to the tooth, cannot be determined from this study. At the end of 4 weeks, the amounts of GCF flow from the experimental and control sulci were similar, stressing the insignificance of applying this antibiotic agent to the periodontal wound surface.

Protecting the wound site from bacterial contamination would seem to be the logical step in achieving optimal healing. Topical application of antibiotics may have definite advantages over the systemic route: it is in direct contact with its target site, the dosage is very small and secondary unwanted side effects, such as nausea, vomiting tinnitus, gastrointestinal and renal problems, etc.[23] are practically nonexistent. However, within the limitations of this study, application of 3% Achromycin on the sutured flaps did not result in an improved healing of the periodontal wounds.

CONCLUSIONS

Within the limits of this investigation, it can be concluded that: (1) The application of a topical antibiotic will not improve the clinical healing of a flap procedure when good flap adaptation is achieved. (2) Further research is needed to evaluate the effect of topical antibiotics upon the clinical healing of other periodontal surgical procedures.

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