The effect of locally applied gauze drain impregnated with chlortetracycline ointment in mandibular third-molar surgery

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A prospective randomized crossover, within-patient, controlled study was performed in 26 healthy patients to test the effect of the prophylactic local use of gauze drain impregnated with chlortetracycline (Aureomycin 3%®, Lederle) ointment on postoperative alveolitis formation after surgical removal of 52 bilaterally impacted mandibular third molars. The teeth were removed on two separate occasions; on one side drain was inserted in the socket, and on the other side no drain treatment was used for control. The influence on postoperative pain, swelling, and mouth opening ability was investigated. The results indicated a statistically significant reduction ($P = 0.02$) in the incidence of postoperative inflammatory complications, defined as postoperative alveolitis, from 35% in the no-drain group to 4% in the drain group. No statistically significant difference was found between the two treatment methods with regard to pain and mouth opening reduction. There was a significant difference between the drain and no-drain treatment with regard to swelling on the 1st postoperative day in favor of the no-drain method. It is concluded that insertion of a chlortetracycline-impregnated drain may be an effective method for reducing postoperative alveolitis formation but has no beneficial effect on pain, swelling, and mouth opening reduction after impacted mandibular third-molar surgery. □ *Alveolitis; mouth opening; oral surgery; pain; swelling*

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Surgical removal of mandibular third molars usually causes discomfort for the patient, including pain, swelling, and decreased mouth opening ability during the first postoperative days. The postoperative course can furthermore be aggravated by wound healing disturbances such as alveolitis. The reported incidence of the different types of alveolitis after surgical removal of impacted mandibular third molars in recent studies have been in the range of 0.4%–36% (1–7), depending on the factors used to identify this condition and methods used for prevention. The most effective results have been obtained with different antimicrobial agents by reducing the bacterial population in the third-molar region (2, 4, 5).

The findings from recent surveys showed considerable variations in the treatment procedures associated with third-molar surgery used by the individual practitioner (8–10). According to the data from a survey performed in Norway in 1989 (8), a gauze drain or pack was used after third-molar surgery by 80% of the respondents ($n = 250$) with different timing of removal. However, there are only a few recent studies in which the effect of a gauze drain on postoperative discomfort in terms of pain, swelling (11, 12), and trismus (13, 14) has been investigated and different results obtained.

At the Department of Oral Surgery and Oral Medicine, University of Oslo, a gauze drain impregnated with chlortetracycline (Aureomycin 3%®, Lederle) ointment has been inserted routinely in the socket after mandibular third-molar surgery. In this study we have used the term postoperative alveolitis to describe postoperative inflammatory complications. It was defined as the presence of one or more of the following postoperative symptoms and signs: disintegration of a blood clot in the alveolus, exposure of alveolar bone, increased pain in the alveolus region, and/or irradiating pain after an intermediate period of no or low-intensity pain, exudation, and/or pus in the alveolar region. In addition to any of these, foul odor might be recorded.

The aim of the present study was to evaluate the effect of a locally applied gauze drain with chlortetracycline ointment on reducing the postoperative inflammatory complications after removal of impacted mandibular third molars and the influence of this drain on postoperative complaints such as pain, swelling, and mouth opening ability.

Materials and methods

Patient selection

The material comprised 30 patients admitted to the Department of Oral Surgery and Oral Medicine, University of Oslo, during the period from February 1996 to September 1996 for removal of the mandibular third molars. The criterion for entering the study was

bilaterally impacted mandibular third molars, which were judged by preoperative clinical and roentgenologic examination (orthopantomogram) to be equal with regard to depth of impaction and position in the mandible and which were considered equally difficult to remove. The teeth were removed for prophylactic reasons (15). The exclusion criteria were systemic diseases, allergies to tetracycline or ibuprofen, use of medication except contraceptives, use of antibiotics or anti-inflammatory medication during the past 2 weeks, symptoms and signs of pericoronitis during the previous 2 months, and a difference in operation time between the first and second operation of more than 10 min. Informed consent was obtained from the participants, and they were also informed that they could withdraw from the study at any time. One patient was excluded from the study before the second operation because of acute pericoronitis. Three patients were excluded after the second operation because of the big difference in the operation time between the two procedures (31, 22, and 11 min). The final material comprised 26 patients (17 women and 9 men), aged 20 to 37 years (mean, 25 years).

Medication

Surgical treatment of the mandibular molars without or with application of a 3 × 1 cm gauze drain impregnated with chlortetracycline ointment inserted in the socket after removal of the left or right mandibular third molar was randomized in this within-patient controlled crossover study. The no-drain treatment side was used for control.

Surgical procedure

All the surgical procedures were performed by the same surgeon. In all patients the teeth were removed on two separate occasions with a time interval of more than 3 weeks. The side for the first and the second operation was randomly selected. A preoperative mouth rinse for 1 min with 2% chlorhexidine gluconate (Hibitane®, ICI) was performed by all patients. The teeth were removed under local anesthesia with mean quantity of 4.9 ml (range, 2.7–8.1) lidocaine (Xylocain®), 20 mg/ml/epinephrine (Adrenalin®), 12 µl/ml (Astra), in the drain group and 5.0 ml (range, 3.6–5.4) in the no-drain group. A buccal envelope-type mucoperiosteal flap was raised, and a sufficient amount of bone was removed by using burs. The teeth on both sides were removed with sectioning in 14 of 26 patients. The wound was closed with three non-absorbable polyamide sutures (Suturamid, Ethicon). The mean operation time assessed from incision to closure with the last suture in the drain group was 17.2 min (range, 11–34 min), compared with 17.5 min (range, 9–32 min) in the no-drain group.

Ibuprofen in 400-mg tablets was used as analgesic. Starting 2 h after the operation, one tablet was given every 4 h on the day of surgery (2, 6, and 10 h after operation). Later, in the postoperative course, the patients were free to take ibuprofen medication.

Evaluation

All patients were seen on the 3rd and 7th day after surgery and observed independently by two persons other than the surgeon. On the 3rd day those with gauze drain had it removed, and postoperative records were made in both groups of patients. On the 7th day the sutures were removed and records made. The wounds were assessed for the development of postoperative alveolitis, and the following symptoms and signs were used to record the condition: disintegration of blood clot, exposure of alveolar bone, increased pain in the alveolus region and/or irradiating pain after an intermediate period of no or low-intensity pain, foul odor, and exudate and/or pus in the socket. Pain and swelling were registered on a visual analogue scale (VAS) by the patients. The VAS were arranged as 50-mm vertical lines ranging from minimum to maximum at the top for both pain and swelling. The patients started the recordings at 3, 7, and 11 h postoperatively on the day of operation and continued twice daily (0900 h and 2100 h) until the 6th postoperative day. Preoperative mouth opening was measured with a ruler as the distance between the edges of the upper and lower central incisors. Duplicate measurements were made by one of the observers, and the highest result was recorded. The same was done on the 3rd and 7th postoperative days. On the 7th day after the second operation the patients were asked to give an overall preference assessment of the two procedures, in accordance with the following rating: first operation better, worse, or no difference. The patients who developed any complications were seen and treated as necessary in addition to the scheduled visits.

Statistical methods

The occurrence of postoperative alveolitis was tested with McNemar's exact test for correlated proportions. Wilcoxon's matched-pair, signed-rank test with correction for ties was used to analyze pain, swelling, and mouth opening reduction. The results were presented as the mean

Table 1. Postoperative alveolitis in 10 of 52 lower third-molar odontectomies. 'Yes' or 'No' indicates the presence or absence of findings (* recorded in the drain group)

No.	Disintegr. of blood clot	Exposure of bone	Neuralgic pain	Foul odor	Exudate and/or pus	Day when recorded
*1	Yes	Yes	Yes	No	No	3rd
2	Yes	No	No	No	No	3rd
3	Yes	Yes	Yes	No	No	3rd
4	Yes	Yes	Yes	No	No	3rd
5	Yes	Yes	Yes	Yes	No	3rd
6	Yes	Yes	Yes	Yes	Yes	6th
7	Yes	Yes	Yes	Yes	No	7th
8	Yes	Yes	Yes	Yes	No	7th
9	Yes	Yes	Yes	Yes	Yes	7th
10	No	No	No	Yes	Yes	7th

and standard deviation of the mean (*s*). The significance level was set at $P < 0.05$.

Results

Postoperative alveolitis

The overall incidence of postoperative alveolitis was 10 (19%) of the 52 mandibular impacted third-molar odontectomies, with some interobserver variance with regard to the observations but no difference in recording of alveolitis. Of the sockets receiving gauze drain impregnated with chlortetracycline ointment, 1 of 26 (4%) developed postoperative alveolitis, and in the group with no drain, 9 (35%) developed postoperative alveolitis. The difference was statistically significant ($P = 0.02$). Postoperative alveolitis did not appear on both sides in any of the patients (Table 1).

Pain

The pain registration showed no statistically significant difference between the two methods except that the drain group had less pain on the third postoperative morning ($P = 0.04$). At this observation time 14 patients in the drain group and 3 in the no-drain group reported a lower pain score than the respective treatment on the other side. Nine patients reported no difference between the two procedures with regard to pain score. Despite statistical significance by paired comparison at that registration time the mean pain intensity was 3.0 ($s = 5.3$) in the drain group and 3.1 ($s = 2.9$) in the no-drain group. The difference in recorded pain intensity in favor of the drain method compared with the treatment with no drain was small in every patient. One of the three patients who reported more pain in the drain group showed a great difference between the procedures, with 27 mm on the VAS on the drain side and 1 mm (VAS) on the no-drain side. In general, on the operation day and first 2 postoperative days the mean pain intensity was less in the no-drain group, but from the 3rd postoperative day it was the opposite, with less pain in the drain group (Fig. 1).

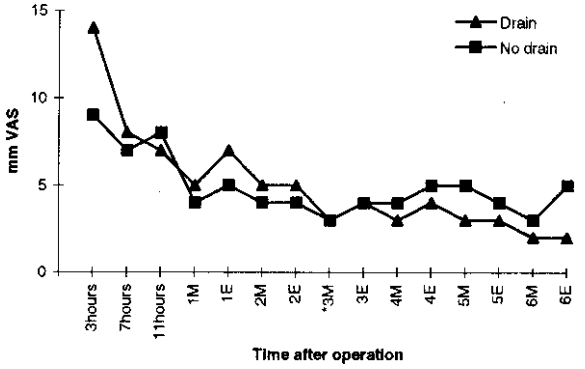

Fig. 1. Mean pain intensity measured on a 50-mm visual analogue scale (VAS) in 26 patients after two identical separate mandibular third-molar odontectomies treated without or with a chlortetracycline (Aureomycin® 3%) ointment-impregnated drain. At 11 h postoperatively recordings were made by 21 patients, as no assessment was performed after 2400 h. M = 0900 h; E = 2100 h. Ibuprofen, 400 mg, medication taken 2, 6, and 10 h after surgery. Despite an equal mean pain intensity for the two groups at 3M, a statistically significant difference was found by paired comparison at that time ($P = 0.04$). * Statistically significant difference, $P = 0.04$ (3M).

Swelling

No statistically significant difference was found between the swelling registrations for the two methods except in the morning ($P = 0.04$) and evening ($P = 0.01$) of the 1st postoperative day, with less swelling in the no-drain group. In general, during the operation day and first 3 postoperative days the mean swelling was less in the no-drain group, but from the 4th day it was low and at a similar level for both groups (Fig. 2).

Mouth opening

Paired comparison of the mouth opening reduction showed no statistically significant difference. The mean mouth opening reduction on the 3rd postoperative day was 8.3 mm ($s = 6.8$) in the drain group and 9.0 mm ($s = 7.6$) in the no-drain group, and on the 7th postoperative day 3.4 mm ($s = 4.1$) and 6.2 mm ($s = 7.9$), respectively.

Preference

On the 7th day after the second operation 13 patients preferred the postoperative course when the drain was used, 8 patients preferred the procedure without the drain, and 5 reported no difference with regard to the two procedures.

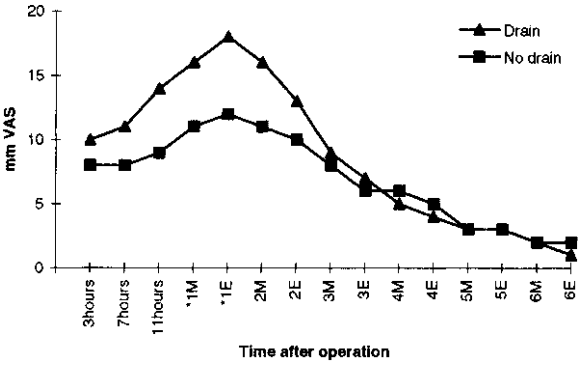

Fig. 2. Mean swelling measured on a 50-mm visual analogue scale (VAS) in 26 patients after two identical separate mandibular third-molar odontectomies treated without or with a chlortetracycline (Aureomycin®, 3%) ointment-impregnated drain. At 11 h postoperatively recordings were made by 21 patients, as no assessment was performed after 2400 h. M = 0900 h; E = 2100 h. * Statistically significant difference, $P = 0.04$ (1M), $P = 0.01$ (1E).

Complications

In one patient temporary labial dysesthesia occurred on one side. Normalization of sensation was recorded after 3 months.

Discussion

In the present study we have used the occurrence of postoperative alveolitis, pain, swelling, and mouth opening reduction as factors for evaluating the use of a gauze drain impregnated with chlortetracycline ointment in connection with mandibular third-molar surgery. The crossover clinical trial design was used, and drain or no-drain treatment methods were applied in the same patient, thereby precenting age, gender, the use of oral contraceptives, different habits, and similar factors from influencing the results. However, the problems of carryover effects and the high level of surgical skill required by the present method to avoid reduced method sensitivity have been recognized (16) and may have affected the results.

The VAS has long been described as a reliable and sensitive method for assessment of pain (17) and has also been used for swelling assessment (18, 19).

Ibuprofen, which we have used as an analgesic, has been repeatedly shown as effective after third-molar surgery (20, 21) with a potent anti-inflammatory effect (20). The fact that the patients used analgesic in the same manner on the operation day only and that they were free to take medication from the first postoperative day may have influenced our results. Unfortunately, the consumption of analgesic tablets during the postoperative course was not recorded.

The findings of the present study may indicate that locally applied gauze drain impregnated with chlortetracycline ointment is an effective method for reducing the incidence of postoperative alveolitis when compared with no local medication after impacted mandibular third-molar surgery. Significant reduction of the alveolitis occurrence from 35% in the no-drain group to 4% in the drain group is in agreement with previous controlled studies in which various locally applied tetracycline preparations have been used (2, 22–26). The alveolitis percentage rates for the no-drain group in the present study appeared quite high. This may be explained, in part, by the very liberal definition of postoperative alveolitis. In fact, it includes wound healing disturbances such as infection, dry socket, disintegrated blood clot, and flap reflection. The high incidence of alveolitis may be related to the removal of bone in all odontectomies and to the sectioning of teeth (23, 25) in 14 of 26 patients. In 7 of the 10 cases of alveolitis the teeth were sectioned.

No significant difference in pain was found between the two methods over a 7-day postoperative period in this study. It has to be mentioned that the occurrence and treatment of alveolitis could affect the pain recordings. It has been well documented that pain after third-molar surgery reaches its maximum intensity in the first 12 h with variation in the peak point in different studies (19, 27, 28). Our findings showed that the most intense pain occurred on the day of operation, with the peak 3 h after surgery in the two groups. Since we did not find a positive effect of the drain method on pain, the pre-emptive use of ibuprofen to improve the patients' satisfaction by delaying onset could be considered (29, 30).

In this study the patient assessment of postoperative swelling was characterized by a relatively low level on the day of operation, reaching its maximum on the evening of the 1st postoperative day. This was in general agreement with a report by Berge & Bøe (19), who used the same method for registration of swelling. We found higher swelling in the drain group up to the 3rd postoperative day with statistically significant difference on the 1st postoperative day. We expect that the inside swelling was taken into account when assessed by the patients on the VAS. Unfortunately, there is no objective method for assessing the inside swelling, and we did not measure the objective outside swelling.

The scores for postoperative mouth opening ability showed no statistically or clinically significant difference between the two methods. This indicator was not related to the high incidence of alveolitis in the no-drain group.

The patients' overall assessment of the postoperative course was in favor of treatment with a drain, obviously due to the occurrence of postoperative alveolitis on the no-drain side. However, some patients claimed they had a sensation of discomfort on the drain side that was not associated with the postoperative alveolitis.

In contrast to our findings, Hellem & Nordenram (13) observed that sockets dressed with Whitehead's varnish-impregnated drain had reduced pain, swelling, and trismus when compared with systemic penicillin or lincomycin, or no medication. Holland & Hindle (11) also reported less pain and swelling on the side dressed with Bismuth Iodoform paraffin paste-impregnated ribbon gauze when compared with sockets closed completely in the model of bilateral symmetrically impacted third molars. Lyall (12) used the same model and local medication. In addition, he investigated the influence of prophylactic systemic metronidazole on the outcome. Less pain and swelling occurred on the dressed side in the no-metronidazole group. In contrast, the results in the metronidazole group showed that the dressed sides were more swollen, and the pain experience was similar when compared with the closed sides. These findings are in general agreement with the present study. Lyall (12) suggested that anaerobic bacterial contamination overrides any difference between the operative treatments.

In conclusion, the present study showed that the insertion of gauze drain impregnated with chlortetracycline ointment in the socket after mandibular third-molar surgery may be an effective method for reducing the incidence of postoperative alveolitis. No significant effect of the drain on postoperative pain and mouth opening reduction was found when compared with no-drain

treatment. The increased swelling on the 1st postoperative day was considered an indicator of the patients' discomfort when the drain was used. From the present study it may not be concluded which was more effective: the antibacterial effect or protection of the wound with a drain. Further studies are needed, and our next one aims to compare the effect of the locally applied drain with chlortetracycline with that of a drain with sterile petrolatum on the postoperative course in mandibular third-molar surgery.

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