# Pattern of self-administered paracetamol and codeine analgesic consumption after mandibular third-molar surgery

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Pattern of analgesic consumption after unilateral mandibular third-molar surgery was investigated in an open study in 201 patients. All patients were supplied with six analgesic tablets containing 500 mg paracetamol and 30 mg codeine. Instructions for use were given. A mean consumption of 4.9 tablets over the 1st week and 3.6 tablets the day of operation was found. Eight (4%) patients indicated inadequate or no effect of the medication. The remaining patients were able to control pain, to a level of one-third of maximum pain, by using from one to five tablets. One hundred and thirty-two (68%) patients followed instructions with regard to start of medication. No difference in mean tablet consumption was found between compliant patients and those who delayed the intake of the first analgesic dose by more than 1 h. Predictor analysis showed the most powerful predictors to be preoperative depth of the third molar and moderate or heavy smoking. Thirteen per cent explanatory power of all predictors together was found.
☐ *Molar, third; paracetamol; postoperative pain; surgery, oral; tooth extraction; tooth, impacted*

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Pain after surgical removal of mandibular impacted third molars affects nearly all patients. It reaches maximum intensity after 6–8 h and drops markedly after the 1st postoperative day (1–3). Postoperative analgesic medication is consequently required by most patients (4). Pain and analgesic consumption have been associated with inability to work after third-molar surgery (5). Postoperative pain and pain control are important factors in patients' overall perception of surgical treatment (6).

Postoperative information is believed to be of major importance in relation to pain control and patients' ability to cope with the unpleasant phenomena that occur after surgical procedures (7). Knowledge of expected postoperative reactions, including demand for analgesic medication, will be of importance in relation to pre- and post-operative information.

Postoperative analgesic consumption has been used as an indicator of the postoperative course after third-molar surgery (7–9) and also for thoracic (10), abdominal (11), and orthopedic surgery (12). It has been claimed that if pain is treated prophylactically, the amount of drugs required is considerably less than if treatment is delayed until pain becomes severe (1, 13–15). Background data on associations between patient and operative variables and demand for analgesics, in addition to information on patient compliance with given instructions on how to use the medication, however, seem to be lacking.

The aims of the study were to evaluate the pattern of self-administered analgesic consumption after third-molar surgery, in relation to some pre- and per-operative variables, and to assess possible effects of patient compliance on consumption of analgesics, using a common postoperative analgesic regimen.

## Patients and methods

### *Patients*

A total of 201 consecutive patients in general good health, without regular medication, except 27 females taking oral contraceptives and 8 patients taking nonsteroid antiallergic medication, were included in this open study. The 102 males and 99 females, with a mean age of 25.1 years (range, 17–47 years), were all referred to or had reported to the Oral Surgery Clinic at the Dental School, University of Bergen, for surgical removal of a single impacted mandibular third molar. None of the patients had any previous experience with significant orofacial pain or oral surgery procedures. All patients volunteered to fill out forms to register pain and consumption of analgesics. Indications for removal are listed in Table 1; some preoperative characteristics are shown in Table 2.

### *Surgical procedure*

Surgical removal was performed with the patient under local anesthesia, using approximately 3.6 ml of lidocaine hydrochloride 2%, with adrenaline, 12.5 μg/ml (Xylocain-Adrenaline®, Astra), as a mandibular block injection and buccal infiltration. A buccal flap approach was used through a standard envelope incision, and buccal bone removal was done as needed. Tight wound closure with two sutures (Vicryl) and

Table 1. Principal indications for removal of impacted mandibular third molars in 201 patients

| | *n* | % |
|---|---|---|
| Partially erupted | 88 | 44 |
| Previous or present infection | 51 | 25 |
| Orthodontic considerations | 24 | 12 |
| Present pain | 22 | 11 |
| Caries | 14 | 7 |
| Resorption, cystic lesion | 2 | 1 |

insertion of a gauze drain impregnated with chlortetracycline (Aureomycin®, Lederle) ointment completed the procedure. Intraoperative tooth divisions were done in 128 (64%) cases: one split in 25 cases, two splits in 63 cases, three splits in 35 cases, and four splits or more in 5 cases. Bone removal and tooth divisions were done with a conventional drill, under copious irrigation with normal saline. Drains were removed after 24 h. No antibiotics or steroid medication was given. Mean operating time from incision to completion of the last suture was 9.8 min (range, 3–34 min).

*Analgesics*

A commercially available analgesic tablet preparation was used, containing paracetamol (500 mg) and codeine (30 mg) (Pinex Forte®, AL), here referred to as tablets. Patients were given verbal and written instruction to take one tablet within 1 h postoperatively and then 1–2 tablets when beginning to feel pain. Written information on a 24-h maximum dose of six tablets was given, as was a standardized orientation on the anticipated pain, swelling, trismus, and discomfort normally following this procedure. Patients were offered rescue medication by phone contact with the surgeon and further supply of analgesics at a follow-up appointment the 1st postoperative day.

*Outcome measures*

All patients were supplied with a one-sheet form containing instructions on recording of pain levels at specified intervals using 50-mm visual analogue scales (VAS), with end-markings reading 'no pain' and 'unbearable pain'. Analgesic tablet consumption, number and times of intake, was also to be recorded. Adverse effects were recorded by the patients in response to the question: 'Did the tablets upset you (adverse effects) in any way?'.

*Statistics*

The chi-square test was used to test univariate

Table 2. Multiple classification analysis of the influence of some predictors on consumption of analgesic tablets containing 500 mg paracetamol and 30 mg codeine, after removal of impacted lower third molars in 201 patients

| | | Unadjusted | Adjusted | |
|---|---|---|---|---|
| Predictor | *n* | Eta | Deviation from Grand mean | Beta |
| Depth | | | | |
| Superficial* | 100 | 0.22 | −0.30 | |
| Deep | 101 | | 0.30 | 0.23 |
| Operation in | | | | |
| Morning | 143 | 0.17 | 0.15 | |
| Afternoon | 58 | | −0.37 | 0.18 |
| Smoking | | | | |
| None | 123 | | −0.16 | |
| 1–9 cig/day | 37 | | 0.09 | |
| 10–19 cig/day | 30 | | 0.42 | |
| >19 cig/day | 11 | 0.15 | 0.33 | 0.17 |
| Pericoronitis | | | | |
| Present | 28 | 0.17 | −0.38 | |
| Not present | 173 | | 0.06 | 0.12 |
| Alcohol use | | | | |
| None | 49 | | 0.15 | |
| Once a month | 47 | | 0.04 | |
| Once a week | 62 | | 0.04 | |
| Once every 2nd day | 43 | 0.07 | −0.27 | 0.11 |

* More than one-third of crown above level of cementoenamel junction of second molar.
Grand mean = 3.66 tablets; multiple $R^2$ = 0.131.

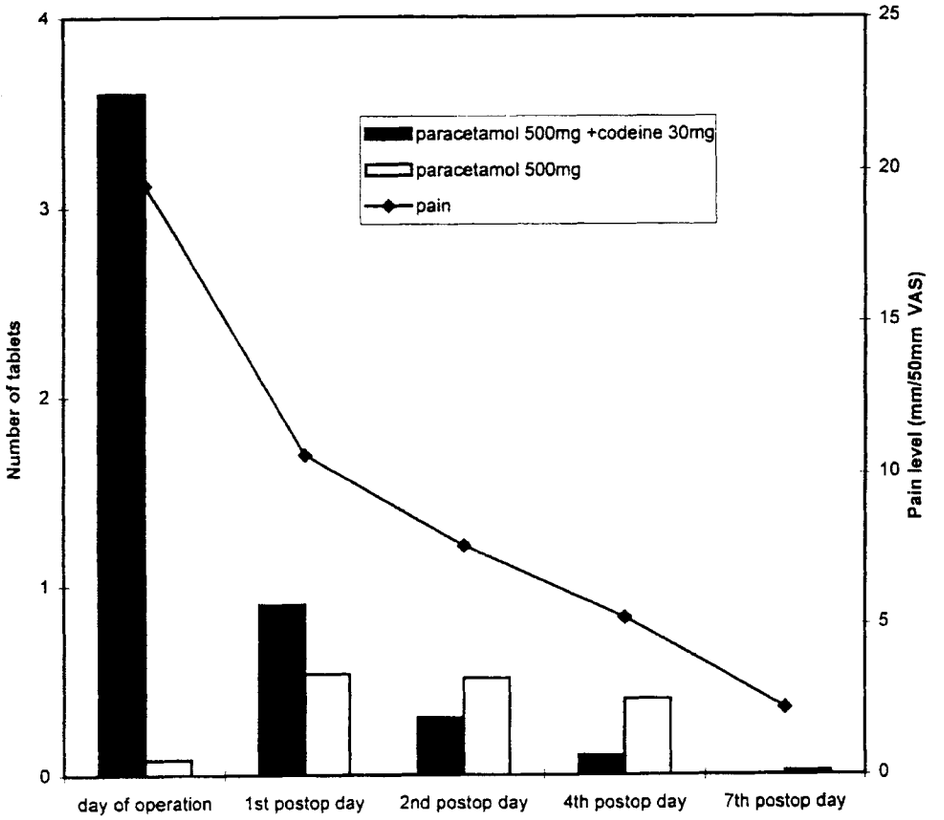


Fig. 1. Mean tablet consumption and indicated pain levels the 1st week after removal of impacted mandibular third molars in 201 patients.

differences of proportions. Pearson's product moment correlation coefficient was used to correlate continuous variables. Multiple classification analysis (16) was used to evaluate bivariate (eta) and multivariate (beta) effects of predictor variables in addition to the proportion of variance of the dependent variable explained by the predictors simultaneously (multiple $R^2$). Rank order of betas indicates relative importance of predictors in explaining variance in the dependent variable.

## Results

None of the patients indicated any difficulties in reporting pain and analgesic consumption. Mean reported subjective duration of numbness in lower lip, indicating the effect of the local anesthesia, was 3.9 h (median, 4 h; range, 1–8 h). Mean total analgesic consumption during the 1st postoperative week was 4.9 tablets (range, 0–19 tablets). In addition, a mean of 1.5 nonprescription analgesic tablets containing 500 mg paracetamol was used, predominantly after the initial reduction of pain intensity (Fig. 1). Distribution of analgesic consumption over the first postoperative week (Fig. 1) shows that 73% of the paracetamol + codeine combination was used the day of operation, and an additional 18% the 1st postoperative day. No spontaneous reports of side effects were recorded.

Fig. 2 shows distribution of number of tablets used the day of operation. Mean consumption was 3.7 tablets, with a median of 4 tablets. Corresponding mean VAS pain registrations between 6 h postoperatively and 2200 h the day of operation are also shown in Fig. 2. Patients using from one to five tablets indicated an even pain level at 17–21 mm on the VAS, whereas six patients taking no tablets and nine patients taking six or more tablets indicated an increased pain level. Hourly distribution of tablets taken the day of operation (Fig. 3) shows a marked peak at 4 h postoperatively and a less pronounced peak at 7–8 h postoperatively, indicating average dose intervals of approximately 3 h. The instructions with regard to intake of the first dose was followed by 132 (68%) patients.

After making adjustments for cigarette smoking habits, depth of tooth, and duration of operation, possible effects of noncompliance with the proposed

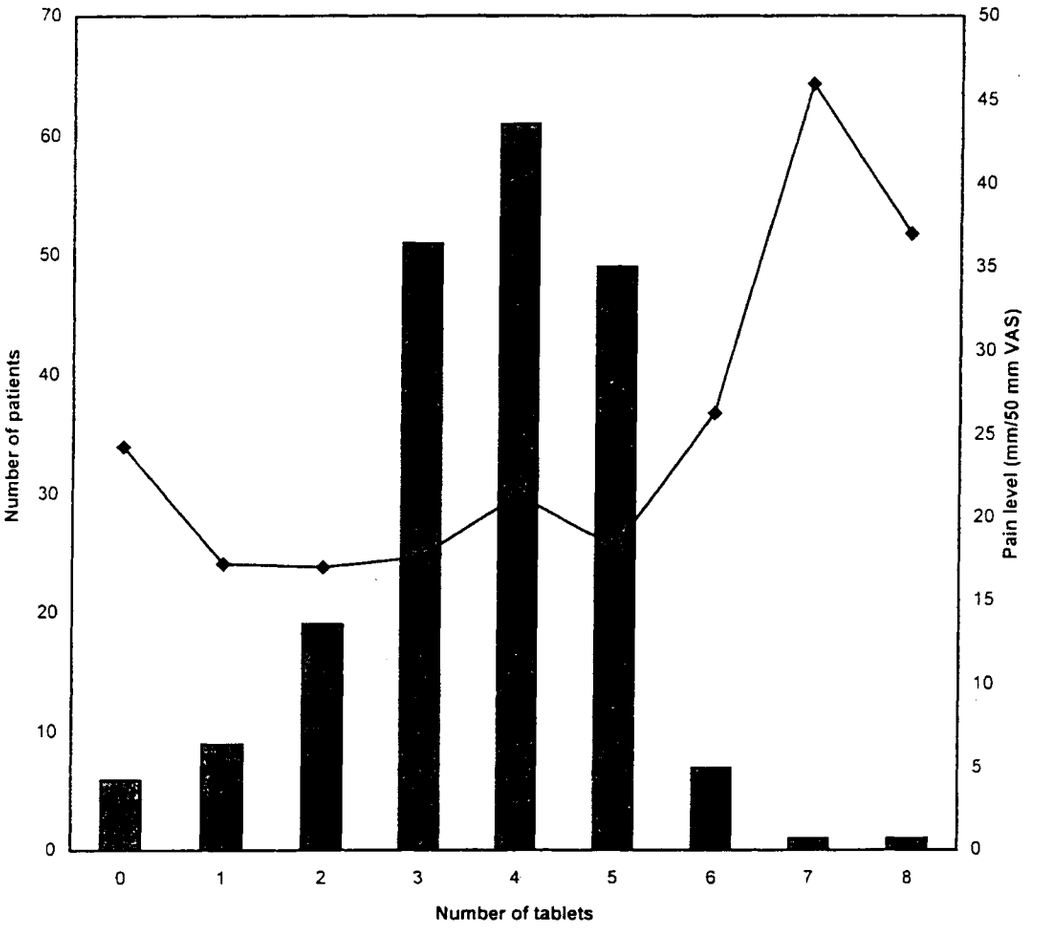


Fig. 2. Consumption of analgesics and mean pain scores 6 h postoperatively to 2200 h on the day of operation, after removal of impacted mandibular third molars in 201 patients.

analgesic regimen were studied. A slight tendency to increased need of analgesics associated with early first-dose intake was noted; however, these patients tended to wait longer until taking the second dose than those who delayed the first-dose intake by 2 or 3 h.

Investigations of bivariate associations showed an increased use of analgesics associated with deeply located teeth ($P < 0.05$) and a weak but positive correlation ($r = 0.155$; $P < 0.05$) between duration of operation and number of tablets used the day of the operation. Furthermore, moderate and heavy smoking (more than nine cigarettes per day) was associated with increased (+0.6 tablets) use of analgesics compared with patients smoking nine cigarettes or less per day ($P < 0.05$). A tendency to increased use of analgesics was reported by patients without pericoronitis and with horizontally or mesially inclined third molars. No association was found between number of tablets or time of first dose and duration of the local anesthesia.

Multivariate associations were evaluated using multiple classification analysis. The influence of the strongest predictors according to the univariate analyses is shown in Table 2. Only 13.1% of the variation in consumption of paracetamol + codeine tablets was explained by these predictors. A second multiple classification analysis showed that further predictors related to the tooth and surgical procedure—sagittal angulation, number of divisions during surgery, and, as covariant, duration of surgery—altogether explained ($R^2$) 10.8% of variations in tablet consumption.

## Discussion

The paracetamol and codeine combination was chosen because it is a commonly used analgesic after third-molar surgery in several countries, including Britain (17) and Norway (18). The recommendation to take the initial dose before the onset of pain was based on several studies (1, 14, 15). The mean total demand for post-

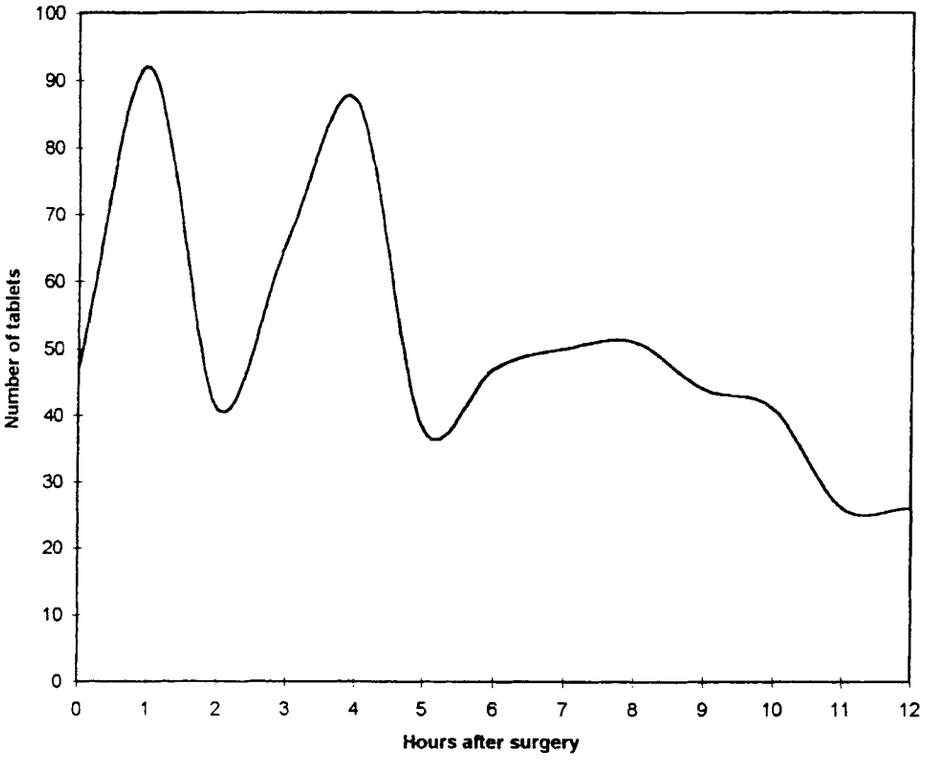


Fig. 3. Time distribution of consumption of analgesic tablets after removal of impacted mandibular third molars in 201 patients.

operative prescription analgesics was markedly lower than reported by Seymour et al. (4) and Chapman (19) in similar study settings. It seems that overall analgesic consumption does not increase by allowing patients to administer the medication themselves. The relationship between pain levels and analgesic consumption during the 1st postoperative week (Fig. 1) furthermore indicates that patients do not overuse postoperative analgesics. The time distribution of tablet consumption (Fig. 3) suggests that the clinical effect of single doses of 500 mg paracetamol and 30 mg codeine lasts for about 3 h. Needs for analgesics seem predominantly limited to the day of surgery and, to a lesser degree, the 1st postoperative day. This may be an important element in postoperative information directed to patients.

The mean VAS pain indication from 6 h postoperatively to 2200 h may serve as an indicator of experienced pain, under the influence of the analgesic medication, in the immediate postoperative period of maximum-intensity pain (3, 20, 21), after cessation of the effects of the local anesthetic. The results in Fig. 2 indicate that patients, by administering analgesic medication themselves, are able to control pain at a level of approximately one-third of 'unbearable pain'. This may explain poor correlation between level of pain and use of analgesics as reported by Feinmann et al. (22), in contrast to Seymour et al. (4), who reported increased use of analgesics in patients indicating increased levels of pain. Six (3%) patients requiring six tablets indicated increased pain levels and thus seemed to have inadequate analgesic effect. Two patients taking seven and eight tablets, respectively, did not seem to obtain an analgesic effect at all from the paracetamol–codeine combination offered in this study.

Incidences of side effects from analgesics containing paracetamol and codeine varying from 57% (23) to none (19) have been reported. Side effects have been suggested to occur in a dose- and weight-dependent relationship (23–25). The results in Fig. 2 indicate that patients did not stop taking analgesics because of unrecognized or unreported side effects. Although the threshold for reporting side effects in this study may be high, the absence of spontaneous reports of side effects indicates that this incidence may be reduced when the initial dose is kept to a minimum, and patients are allowed to adopt dosage to individual and subjective needs.

The present patient-compliance rate of 68% was far lower than expected. A direct question on reasons for not following instructions was unfortunately not included. Despite written and verbal explanations of the rationale for taking the first dose before the onset of pain, as pointed out by Ahlström et al (14), 64 patients chose a 'wait-for-the-pain' approach. These patients recorded a shorter interval between the first and the

second intake of analgesics. Comparison of pain levels at several intervals in these two groups did not show any differences, indicating that pain could be controlled by either approach. Mean consumption of analgesic tablets was equal in these two groups, apart from a slight tendency for a total dose reduction with increasing delay of intake of the first dose. Reasons for not following recommendations may include undervaluation of postoperative pain and disapproval of taking medication in general. Compliant and noncompliant patients may differ in personality characteristics, which may influence perception of pain (8). However, the two groups seem to be able to control pain at the same indicated level, using the same amount of analgesics.

Nearly no escape medication was required on the day of operation (Fig. 1), supporting the conclusion that patients are able to control pain to an acceptable level by self-administration of analgesics. This is in contrast to reports (26, 27) claiming that the use of analgesics 'as needed' leads to patients suffering unnecessary pain due to inadequate analgesic effect. These studies were made on chronic pain patients or patients receiving opioids for postoperative pain, thus being of limited relevance for the present study situation.

Predictor analysis showed that technically difficult teeth—deeply located and long duration of operation—were associated with increased use of analgesics. Oikarinen (28) found increased level of postoperative pain associated with technically difficult operations of long duration. However, in the present group of patients this association was low (3). In addition to a possible direct cause-and-effect relationship, patients' expectations of increased pain after what has been perceived as a difficult procedure may in some cases have led to increased consumption of analgesics. The observed lack of association between duration of anesthesia and consumption of analgesics may be due to a time-dependent selective effect of the anesthetic on different nerve fibers, so that the patients will feel pain while numbness of the lower lip is still present.

Heavy cigarette smoking has been associated with an increased demand for paracetamol, due to smoking-induced increased glucoronidation activity (29, 30). This effect has been claimed to be without clinical significance (31). The increased amount of postoperative analgesics required by heavy and moderate smokers indicates that this effect may be clinically important, with relations to both dosage and information. Several studies using the dental pain model (13, 19, 23–25) contain no information on patients' smoking habits, which might have biased the results.

The explanatory power of the predictors used in this study was weak, as 87% to 89% of the variation in analgesic use remains unexplained. This is parallel to the weak explanatory power of similar predictors with regard to variations in pain, swelling, trismus (3), and inability to work (6) after mandibular third-molar surgery.

The findings of this study will contribute to postoperative information about the need for and timing of analgesic use and will in this way contribute to improved postoperative pain control, which, together with reassurance, constitute the most important factors for patients in third-molar surgery (5). Increasing amount of postoperative information may increase pain relief and satisfaction with pain control without increasing analgesic consumption (7). The findings also have methodologic implications; in future studies of analgesic efficacy, the distribution of significant predictors in various patient groups should be considered, to keep influence from background variables at a minimum.

The following conclusions are related to self-administration of analgesic tablets containing 500 mg paracetamol and 30 mg codeine after mandibular third-molar surgery: Patients with adequate analgesic effect from this paracetamol + codeine combination seem to be able to control early postoperative pain to a level of one-third of maximum pain, by self-administration of analgesics. By this form of administration, more than 98% of patients will be adequately supplied by using six tablets. Patients who are moderate or heavy smokers with operatively 'difficult' third molars may need increased amounts of analgesics. Apart from these cases, individual prediction of need of postoperative analgesics is not possible in clinical practice. Compliance with instructions to take the first analgesic dose before onset of pain does not reduce demand for analgesics.

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