Recovery After Third Molar Surgery: Clinical and Health-Related Quality of Life Outcomes

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Purpose: The study goal was to assess both clinical and health-related quality of life (HRQOL) outcomes after third molar surgery.

Methods: Patients who were having 4 third molars removed were enrolled in a prospective clinical trial. Baseline data were recorded that included demographics, the patient's and surgeon's assessment of third molar conditions, and details of the surgical procedure. After surgery, clinical data were collected that detailed healing and any treatment that was rendered. Each patient was given an HRQOL instrument to complete on each postsurgery day for 14 days; the instrument was designed to assess a patient's perception of recovery in 4 main categories: pain, lifestyle, oral function, and other symptoms related to the procedure.

Results: Recovery data were available for 630 of 740 enrolled patients. The median age of the 630 patients was 21 years, and the median operation time was 30 minutes. Recovery for most HRQOL measures occurred within 5 days after surgery. However, recovery from pain to the criterion of "little or none" was delayed relative to other HRQOL measures. Twenty-two percent of patients were treated for delayed healing after surgery.

Conclusions: Having both clinical and HRQOL data on recovery after third molar surgery could assist the surgeon when informing prospective patients about what to expect after surgery to remove third molars.

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Patients who seek third molar surgery expect the surgeon to explain the risks and benefits of the planned procedure as well as details of recovery from the surgery. Data from case series on clinical outcomes of third molar surgery such as wound infection rates and the frequency of localized osteitis have been available for more than a decade.[1-3] Recovery for health-related quality of life (HRQOL) measures, a

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patient's perception of recovery that includes return to a usual lifestyle, recovery of oral function, and the absence of pain, has been only recently studied. Shugars et al[4] and Conrad et al[5] detailed recovery by assessing HRQOL measures during a 14-day period after surgery. Other authors have reported outcomes for selected lifestyle measures after surgery.[6-10] Here, we report both clinical and HRQOL outcomes after third molar surgery in patients who were treated in a prospective, clinical trial conducted at multiple clinical sites, including community and academic practices.

Methods

To assess recovery for both clinical and HRQOL measures, a prospective clinical trial was designed and implemented. Patients with 4 third molars scheduled for removal were enrolled in an institutional review board–approved, prospective clinical trial conducted at community practices and academic clinical centers during a 42-month period. Collectively, the clinical sites were chosen to broadly represent the performance of third molar surgery in the United States. Surgery in community practices was carried out by surgeons who were members or fellows of the American Association of Oral and Maxillofacial Surgeons. Surgery in academic practices was performed by surgery faculty, Fellows of the American Association of Oral and Maxillofacial Surgeons, or residents with at least 1 year of dentoalveolar surgery training after dental school.

Neither patients nor surgeons were compensated for participation in the study. Inclusion/exclusion criteria dictated that patients be healthy (ASA I, II), between the ages of 14 and 40 years, and free of extensive periodontal disease (APA I, II) and have no history of treatment for psychiatric illness. Female subjects could not be pregnant or lactating. A standard surgery protocol maintained across the clinical centers included procedures common to surgery in the United States such as intravenous anesthesia, access to the third molars from the buccal aspect, and bone removal for lower third molars with rotary instruments. A lingual approach to lower third molars and systemic or topical antibiotic or corticosteroid administration at surgery were precluded.

After consenting to participate in the study, and before removal of all 4 third molars, patients had baseline data recorded. These data included demographics (age, gender, race, education level, insurance status), current tobacco use, reasons for seeking third molar removal, current temporomandibular joint symptoms, and prior third molar symptoms and the impact of these symptoms on clinical and HRQOL outcomes. Before surgery, the surgeon recorded an assessment of the clinical condition of each third molar and any indicated preremoval treatment. Immediately after surgery, details of the procedure were recorded, including the anesthetic medications administered, bone removal by third molar, the duration of surgery in minutes, surgery difficulty as perceived by the surgeon with use of a 7-point Likert-type scale for each third molar anchored with the verbal descriptors "least" and "most" difficult, and the discharge medications prescribed. Third molar position and angulation were determined from the presurgery panoramic radiograph. Each third molar was designated as at or below the occlusal plane and mesioangular, horizontal, vertical, or distoangular compared with the long axis of the adjacent second molar.

Table 1. GRACELY SCALES RANKING ORDER OF POSSIBLE VERBAL RESPONSES FOR A PATIENT TO INDICATE PAIN LEVELS BY UNPLEASANTNESS AND SENSORY INTENSITY

Unpleasantness	Sensory Intensity	Rank
Neutral	Nothing	1
Slightly unpleasant	Faint	2
Slightly annoying	Very weak	3
Unpleasant	Weak	4
Annoying	Very mild	5
Slightly distressing	Mild	6
Very unpleasant	Moderate	7
Distressing	Barely strong	8
Very annoying	Slightly intense	9
Slightly intolerable	Strong	10
Very distressing	Intense	11
Intolerable	Very intense	12
Very intolerable	Extremely intense	13

Data from Gracely et al.[11,12]

After surgery, each patient was given the HRQOL instrument or a diary as described by Shugars et al[4] and identical to the one administered in a clinical trial by Conrad et al.[5] The patient was instructed to complete the respective 2 pages of the diary each postsurgery day for 14 days. The HRQOL instrument was designed to assess a patient's perception of recovery in 4 main categories: pain, lifestyle, oral function, and other symptoms related to the removal of third molars.

The patient's average and worst pain levels over the previous 24 hours were assessed with a 7-point Likert-type scale anchored at each end by the verbal descriptors "no pain" and "worst pain imaginable." The patient's report of the sensory perception of pain and the affective impact or unpleasantness of pain being experienced at that moment were recorded daily on Gracely scales by a patient selecting 1 of 13 verbal descriptors[11,12] (Table 1). Patients also recorded whether analgesic medications were taken to control

pain. Medications taken for pain, including over-the-counter (OTC) medications, were recorded daily.

Each day, lifestyle, oral function, and other symptoms were assessed with a 5-point Likert-type scale with the anchors of "no trouble" and "lots of trouble." Lifestyle measures assessed the impact of the surgery on usual daily activity, social interaction, recreation, and sleep. Oral function targeted difficulty with talking, mouth opening, chewing, and eating a regular diet. Other symptoms addressed difficulty with bleeding, bruising, swelling, nausea, food collecting in surgical sites, and bad taste/bad breath. A patient's daily response to each of the HRQOL measures was dichotomized as no substantial interference or substantial interference ("quite a bit or lots"). For the pain measures, a score of 5 or greater on the 7-point scale represented substantial interference. For the other HRQOL measures, a score of 4 or 5 on the 5-point scale was the criterion. The responses to the Gracely scales that captured the patient's current pain perceptions were transformed to the previously established numerical rank order[12]; a patient's unpleasantness and sensory responses were assigned the rank value for each postsurgical day (Table 1).

Recovery for each HRQOL measure was defined as the number of days before a patient reported "little or no trouble or pain" with that HRQOL measure. The criterion for recovery was a score of 1 ("none") or 2 ("little") on both the 5- and 7-point scales.

Patients were not required by the protocol to return for a postsurgery visit but were encouraged to do so if symptoms worsened after the first few postsurgery days or if the patient wanted a surgeon's clinical assessment of the healing process. If the patient returned, clinical data were collected that detailed healing, and any treatment that was rendered was recorded. A postsurgery visit with treatment, indicating some delay in wound healing, was defined as a visit on which at least one of the following occurred: an antibiotic or analgesic was prescribed, the surgical site was reopened or debrided or a dressing was placed, or another unspecified treatment was rendered.

All data collection instruments, including HRQOL diaries, were submitted to the data coordinating center. All instruments were designed using the Teleform software package (Cardiff Software Inc, Vista, CA). Forms were visually scanned by the data entry operator for obvious errors in marking and then scanned using Teleform Reader. Any questionable fields were sent to Teleform Verifier, which required the operator to verify or correct data using the source documents. After all entry checks were made in Verifier, the form information was sent to an Access database (Microsoft Corporation, Redmond, WA). Logical field checks were performed using SAS software (SAS Institute, Cary, NC). All electronic data were stored on a secured server, and all physical records are kept in a locked storage facility.

If a completed diary was not received by the data coordinating center, a study coordinator made at least 3 telephone contact attempts at different times of the day to query the patient regarding recovery with a standard questionnaire that included the HRQOL items in the diary. When no diary was returned by the patient, the information about recovery obtained via telephone served as a diary substitute.

Results

During the 5 years of the study, from 1997 to 2001, 740 enrolled patients from 9 community practices across 5 states and 5 academic clinical centers underwent surgery. Every region of the country was represented except the southwest. Clinical and HRQOL data for recovery were available from 630 of the enrolled patients. The return rate was 81% and 90% for academic centers and community practices, respectively. The 110 patients who did not return the diary or respond to a telephone query, thus providing no HRQOL data, were more likely to be male, black, and more highly educated; to use tobacco products; and to have third molar symptoms before surgery. Surgery time and the surgeon's estimate of degree of difficulty did not differ compared with patients who provided HRQOL data. No evidence exists to indicate that the nonrespondents were systematically discouraged from completing the study. HRQOL data by day were not available for 83 of the 630 patients; responses to a diary substitute were obtained via telephone interview.

The median age of the 630 patients who provided recovery data was 21 years (interquartile range [IQ], 18 to 24 years) (Table 2). More females (61%) than males participated. Eighty-five percent of respondents were white; 8% were black. Sixty-nine percent had completed high school; 18% were college graduates. Tobacco products were used regularly by 18%. Although third party coverage for third molar surgery was not known, 72% had dental insurance. Fifty-four percent had had prior symptoms involving at least one third molar. Seventy-eight percent reported wanting the third molars removed to prevent future problems; 37% because of pain or swelling, most often associated with lower third molars. Only 6% had temporomandibular joint symptoms (limited mouth opening) before surgery. Eighty-six percent of patients had at least one third molar below the occlusal plane; 60% had both lower third molars below; and 45% had all third molars below. Most third molars were vertical or distoangular; 42% had both mandibular third molars so inclined.

Table 2. CHARACTERISTICS OF 630 PATIENTS WITH CLINICAL AND HEALTH-RELATED QUALITY OF LIFE DATA AVAILABLE FOR ANALYSIS

	n*	%
Female	383	61
Male	246	39
White	534	85
Black	53	8
Median age (yr)	21 (IQ 18 = 24)	
Have dental insurance	358	72
	(Data available for 500 patients)	
Use tobacco	71	18
	(Data available for 388 patients)	
Had temporomandibular joint symptoms before surgery	36	6
Had third molar symptoms before surgery	341	54
Reason for removal of third molars		
Pain/swelling	156	37
Prevent future problems	331	78
	(Data available for 424 patients)	

Abbreviation: IQ, interquartile range, 25th to 75th percentile.
*Data not reported for all characteristics for a given patient.

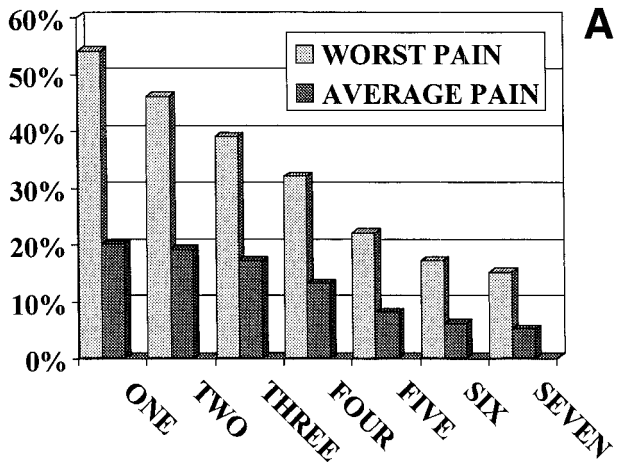
The median surgery time was 30 minutes (IQ range, 20 to 40 minutes). Bone removal at surgery was required for both lower third molars in 33% of the patients; an additional 31% had bone removed in all 4 third molars. Thus, 64% of the patients had bone removal on at least both mandibular third molars. The median estimate of the surgeon's overall degree of difficulty at surgery was 12 of a possible 28 points on the Likert-type scale (IQ range, 9 to 16). Surgeons indicated that mandibular third molars were more difficult to remove (8 of 14) than were maxillary third molars (5 of 14).

Twenty-two percent of the 630 patients who reported recovery data received treatment during at least one postsurgery visit; 11% received treatment during multiple visits (Table 3). Eleven percent of all patients had a dressing placed in a third molar extraction site at the first postsurgery visit. The surgical wound was reopened in 1% and debrided in 7%. Two percent of patients had purulent drainage from the surgery site; antibiotics were prescribed for 3%. Sensory deficit just after surgery was recorded for 10 patients (1.6%). The inferior alveolar nerve was involved in 1% patients (n = 8), and the lingual nerve was involved in 0.3% patients (n = 2). No data were available to determine whether these sensory nerve deficits persisted beyond 2 weeks after surgery.

On postsurgery day 1, 54% of the patients reported the worst pain experienced during the last 24 hours as severe, but only 20% reported their average pain over that period as severe (Fig 1). By postsurgery day 7, 15% of patients still reported their worst pain as severe; 5% reported average pain as severe. On postsurgery days 1 through 3, 13% to 14% patients indi-

Table 3. CLINICAL OUTCOMES: POSTSURGERY VISITS, SIGNS/SYMPTOMS, AND TREATMENT RENDERED RELATED TO THE THIRD MOLAR REMOVAL FOR 630 PATIENTS

	n	%
No postsurgery visit	196	31
Postsurgery visits	434	69
No postsurgery treatment	492	78
At least 1 visit with treatment	138	22
Only 1 visit with treatment	71	11
≥ 2 Visits with treatment	67	11
Signs/symptoms at first postsurgery visit		
Pain	180	29
Debris at site	116	18
Bone exposed	34	5
Purulence	13	2
Sensory nerve deficit	10	1.6
Inferior alveolar nerve deficit	8	1
Lingual nerve deficit	2	<1
Treatment at first postsurgery visit	138	22
Dressing	67	11
Antibiotics	18	3
Reopen or debride wound	48	8
Other	65	10
Signs/symptoms at any subsequent visit		
Pain	55	9
Debris at site	32	5
Bone exposed	19	3
Purulence	2	<1
Treatment at any subsequent visit	67	11
Dressing	39	6
Antibiotics	7	1
Reopen or debride wound	16	3
Other	16	3



B

	1	2	3	4	5	6	7
Patients with severe worst pain (%)	54	46	39	31	22	17	15
Patients with severe average pain (%)	20	19	17	13	8	6	5

FIGURE 1. *A*, Percent of patients reporting pain as severe (score, 5 to 7 on a 7-point Likert-type scale). *B*, Percent distribution of patients (n = 547) reporting worst pain and average pain in the previous 24 hours as severe (score, 5 to 7 on a 7-point Likert-type scale) by postsurgery day.

cated on the Gracely scales that their current pain was "intense, very intense, or extremely intense"; by postsurgery day 7, only 5% gave a similar report (Fig 2). Median sensory levels of pain on the Gracely scales were "moderate" for days 1 and 2 after surgery, decreasing to "very weak" by day 7. In contrast, the current affective perception of pain was low; 4% to 7% reported it as "distressing or intolerable" at the outset, declining by postsurgery day 7 to 2%. Median affective levels of pain on the Gracely scales were "unpleasant" for days 1 and 2 after surgery, decreasing to "slightly unpleasant" by day 7. On postsurgery day 1, almost all patients (96%) were taking analgesic medications for pain (Fig 3). By postsurgery day 7, 55% were still taking pain medications; 13% were still taking medications for pain on postsurgery day 14.

Surgery affected the lifestyle of half the patients "quite a bit" or "lots" on postsurgery day 1 (Fig 4). The day-to-day decrease in the percentage of patients who reported substantial interference in usual daily activity and social life was similar; the decrease for sports or recreation was slightly more delayed. Sleep was affected on day 1 in only 19% of the patients.

Most patients had compromised oral function on postsurgery day 1 (Fig 5). The patterns of decline in the percentage experiencing problems with mouth opening, return to a regular diet, and chewing were similar, with chewing lagging behind slightly during the first postoperative week. Approximately one fourth reported problems with talking on postsurgery day 1.

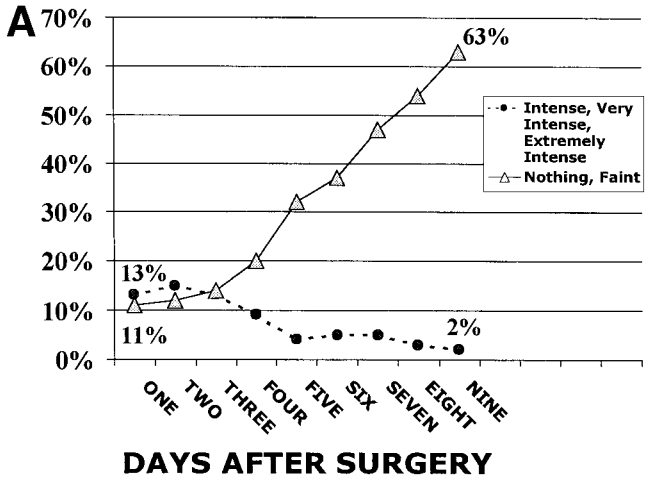
On postsurgery day 1, approximately one third of patients reported "quite a bit" or "lots" of trouble with swelling and bleeding (Fig 6). Less than 20% cited nausea and only 5% cited bleeding as problems. Difficulty with nausea subsided quickly, with less than 10% reporting substantial problems on postsurgery day 2. Swelling seemed to peak on postsurgery day 2, bothering 46% patients "quite a bit/lots"; by day 5, it affected very few patients, 7%. Bad taste/bad breath bothered 35% of patients "quite a bit/lots" on postsurgery day 1; the problem affected only 11% patients by the end of the first week (Fig 7). Although food collecting bothered at most 15% patients on any postsurgery day, the problem appeared to linger for those affected.

Recovery, the median number of days to "little or none/no trouble" for all of the HRQOL measures, except pain and return to regular diet, was reached within 5 days after surgery: lifestyle, 4 days; absence of other symptoms, 3 days; and return to regular diet, 7 days (Figs 8 to 10). Recovery from pain to the criterion of "little or none" was delayed relative to the lifestyle and other symptom measures. The median number of days to no pain medications (OTC or prescribed by the surgeon) was 7 days (Fig 11). Averaged daily pain required, on average, 8 days to abate; worst pain experienced in the past 24 hours, 9 days. Gracely scale ratings at postsurgery days 7 to 9 indicated that the pain intensity and unpleasantness experienced at that moment were high for less than 5% of the patients (Fig 2).

Discussion

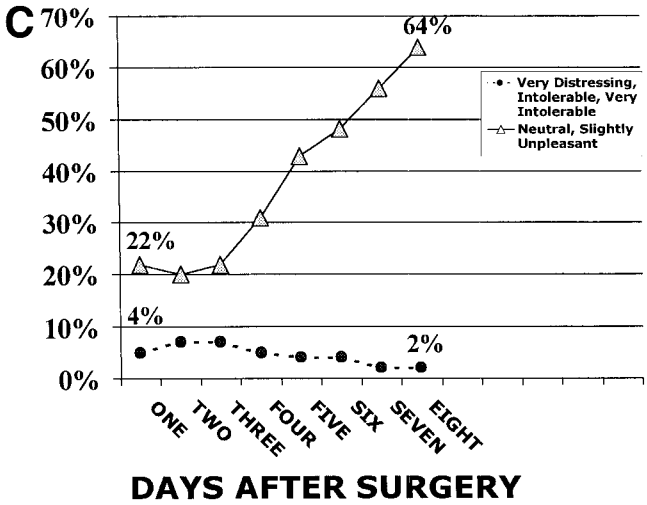
Collectively, the enrolled patients are geographically representative of patients having third molar surgery in the United States. Of the 740 patients enrolled in the study 630 patients (85%) provided data. This rate of completion of the study protocol by the patients is good, although any investigator would like more information as to why specific patients elected not to complete the diary after surgery. Having the study conducted across multiple clinical sites diminished the possibility that patients with specific clinical conditions were encouraged not to complete the protocol.

Clinical data from Goldberg et al,[1] Osborn et al,[2] and Bruce et al[3] have been quite useful to surgeons advising patients on clinical complications after third molar surgery.



B

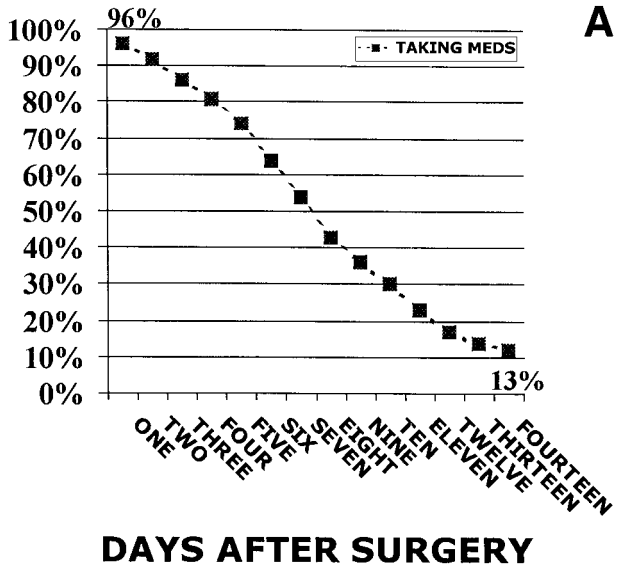
	1	2	3	4	5	6	7	8	9
Intense, very intense, extremely intense (%)	13	14	14	9	4	5	5	3	2
Nothing, faint (%)	11	12	14	20	32	38	47	54	63
Median sensory intensity	Moderate	Moderate	Mild	Mild	Very mild	Weak	Very weak	Faint	None



D

	1	2	3	4	5	6	7	8
Very distressing, intolerable, very intolerable (%)	4	7	8	5	4	4	2	2
Neutral, slightly unpleasant (%)	22	20	22	31	43	49	56	64
Median unpleasantness	Unpleasant	Unpleasant	Annoying	Unpleasant	Slightly annoying	Slightly annoying	Slightly unpleasant	Neutral

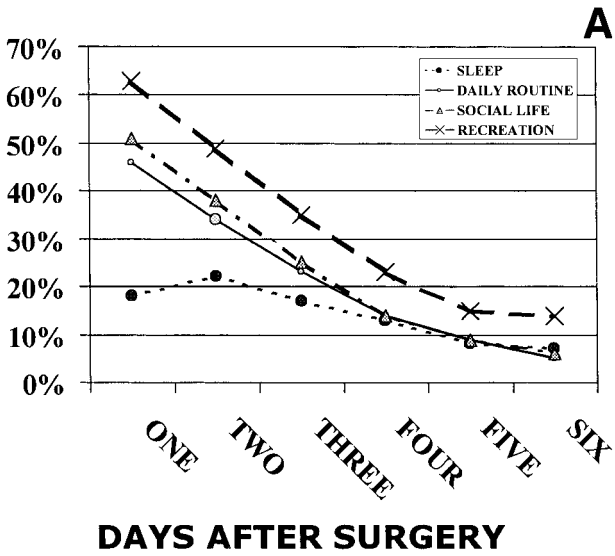
FIGURE 2. *A,* Percent of patients reporting sensory intensity of pain. *B,* Percent distribution of patients (n = 341) reporting the sensory intensity of pain as "intense, very intense, or extremely intense" or "nothing or faint" and median levels on Gracely scales by postsurgery day (see Table 1).[11,12] *C,* Percent of patients reporting unpleasantness of pain. *D,* Percent distribution of patients (n = 341) reporting the affective or unpleasantness of pain as "very distressing, intolerable, or very intolerable" or "neutral or slightly unpleasant" and median levels on Gracely scales by postsurgery day (see Table 1).[11,12]



B

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Patients taking medication (%)	96	92	87	82	75	65	55	45	38	31	24	18	15	13

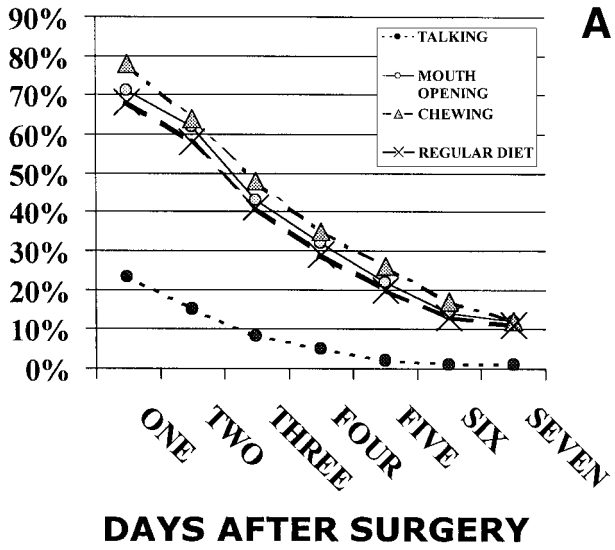
FIGURE 3. *A*, Percent of patients taking analgesic medications. *B*, Percent distribution of patients (n = 547) taking analgesic medications by postsurgery day.



B

	1	2	3	4	5	6
Sleep (%)	19	21	17	13	8	7
Daily activity	46	33	23	14	9	5
Social life (%)	51	38	25	14	9	6
Recreation (%)	63	49	35	23	15	12

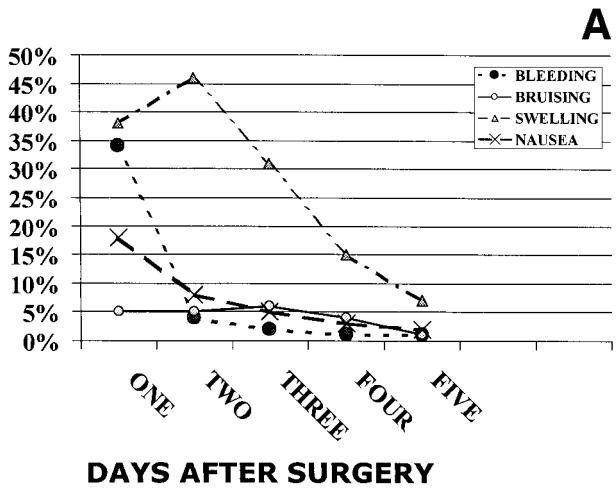
FIGURE 4. *A*, Percent of patients for whom surgery interfered "quite a bit/lots" with lifestyle. *B*, Percent distribution of patients (n = 547) indicating that surgery interfered "quite a bit/lots" with lifestyle (score, 4 or 5 on a 5-point Likert-type scale) by postsurgery day.



B

	1	2	3	4	5	6	7
Talking (%)	23	14	8	5	2	1	1
Mouth opening (%)	71	62	43	32	22	14	11
Regular diet (%)	68	58	41	29	20	13	11
Chewing (%)	78	64	48	35	26	17	12

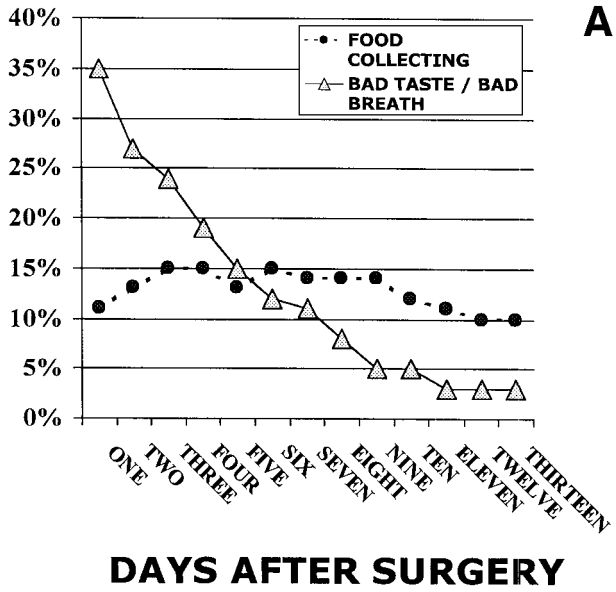
FIGURE 5. *A*, Percent of patients for whom surgery interfered "quite a bit/lots" with oral function. *B*, Percent distribution of patients (n = 547) indicating that surgery interfered "quite a bit/lots" with oral function (score, 4 or 5 on a 5-point Likert-type scale) by postsurgery day.



B

	1	2	3	4	5
Bruising (%)	5	5	5	4	2
Nausea (%)	18	8	5	3	2
Bleeding (%)	34	4	2	2	1
Swelling (%)	38	46	31	14	7

FIGURE 6. *A*, Percent of patients for whom surgery resulted in other symptoms "quite a bit/lots." *B*, Percent distribution of patients (n = 547) indicating that surgery produced other symptoms "quite a bit/lots" (score, 4 or 5 on a 5-point Likert-type scale) by postsurgery day.



B

	1	2	3	4	5	6	7	8	9	10	11	12	13
Food collecting (%)	11	13	14	15	13	15	14	14	14	12	11	10	10
Bad taste, bad breath (%)	35	27	24	19	16	13	11	8	5	5	3	3	3

FIGURE 7. *A*, Percent of patients bothered "quite a bit/lots." *B*, Percent distribution of patients (n = 547) indicating that surgery produced problems that bothered them "quite a bit/lots" (score, 4 or 5 on a 5-point Likert-type scale) by postsurgery day.

The mean age of Goldberg et al's 302 patients was 19 years. Sixty-eight percent of Osborn et al's patients were younger than 24 years. Our patients were also young (median age, 21 years). In a more recent study of patients insured for third molar surgery, Eklund and Pittman[13] reported that most third molars were removed between 15 and 25 years of age, with a peak at age 18 years. More women than men had third molars removed in the cited studies,[1-3] a distribution that is similar to our study population.

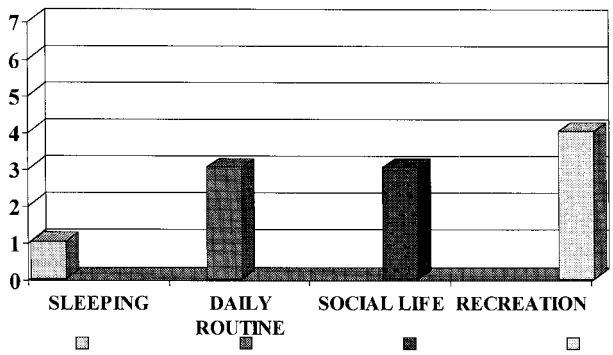


FIGURE 8. Median days after surgery to "little or no" interference with lifestyle.

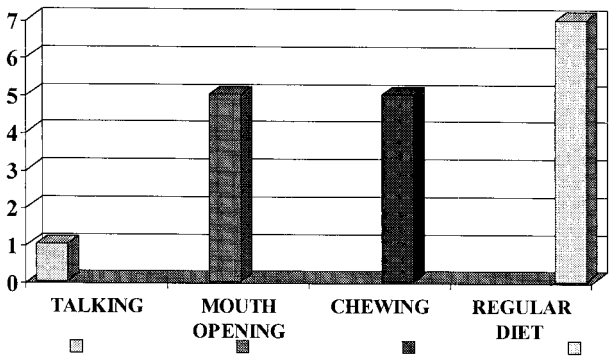


FIGURE 9. Median days after surgery to "little or no" interference with oral function.

In our study population, symptoms related to the third molars before surgery were noted in 54%, less than in Goldberg et al's patients (66%)[1] but more than in the other clinical studies cited. Thirty-seven percent of our patients reported that prior pain or swelling influenced their decision regarding surgery, and 78% reported that avoiding possible future problems was an important reason for seeking removal.

Few of our patients (6%) had difficulty with mouth opening before surgery, a measure of temporomandibular joint dysfunction. Dworkin et al[14] reported similar findings (2.2% for males and 2.5% for females) from the control group in an epidemiologic study of temporomandibular joint disorders. Raustia and Oikarinen[15] studied a group of young patients having third molar surgery and rated each patient with a comprehensive clinical index of temporomandibular joint function. Although the 2 groups are difficult to compare, our patients seemed to have fewer temporomandibular joint complaints before surgery, less than the 45% with moderate dysfunction cited by Raustia and Oikarinen.[15]

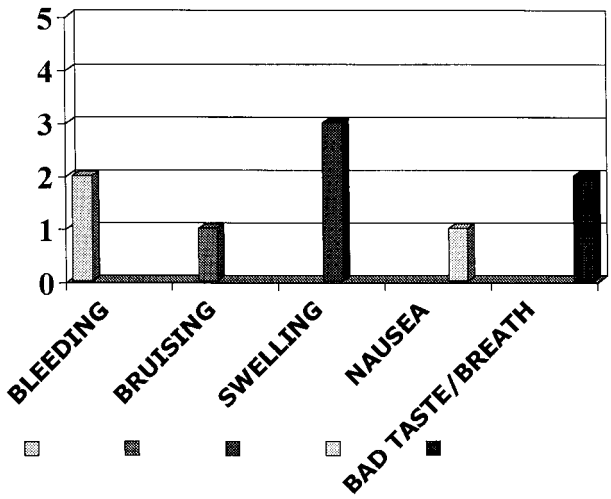


FIGURE 10. Median days after surgery to "little or no" other symptoms.

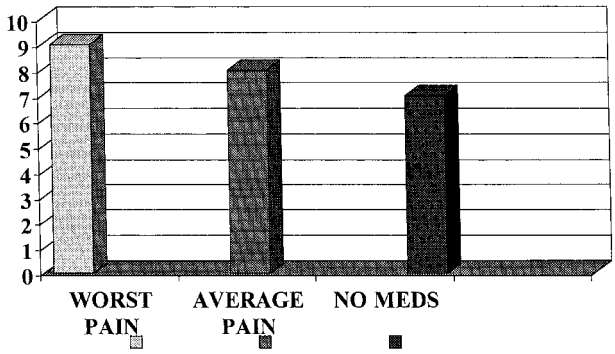


FIGURE 11. Median days after surgery to "little or no pain" or no medications.

Only mandibular third molars below the occlusal plane were included in the studies by Goldberg et al,[1] Osborn et al,[2] and Bruce et al.[3] Eighty-six percent of our patients had at least one third molar below the occlusal plane; both mandibular molars were below in 60% of patients. Although maxillary third molars are not often studied, our patients had all 4 third molars removed. Certainly the removal of maxillary third molars affects clinical and HRQOL outcomes after surgery, although most surgeons believe that the impact of maxillary third molar removal on recovery is usually minimal. In our study, the sum of the surgeon's overall estimate of degree of surgical difficulty for each third molar was affected more often by the rating given for lower third molars.

Only 69% of the 630 patients providing recovery data returned for a postsurgery visit. No additional clinical information was available from the 31% patients who did not return. The absence of these data potentially bias the treatment estimates presented here. If the nonreturning patients experienced clinical problems but chose to see their general dentist or to self-treat, then the estimates would be too low. On the other hand, if patients did not return because no clinical problems were experienced, the estimates presented would be accurate.

Clinical outcomes from our patients were similar to those of Goldberg et al,[1] Osborn et al,[2] and Bruce et al.[3] Of patients who had localized osteitis requiring dressings, Goldberg et al[1] reported 1%, Osborn et al[2] reported 6%, and Bruce et al[3] reported 13.5% compared with our report of 11% who required dressings at the first postsurgery visit. Few of our patients were treated with antibiotics for a problem after surgery (3%), which is comparable to the wound infection rate reported by Goldberg et al[1] (4%) and Osborn et al[2] (6%). Although we had no data more than 2 weeks after surgery, sensory loss across the distribution of the inferior alveolar nerve after surgery seemed comparable: 1% compared with Goldberg et al[1] (<1%), Osborn et al[2] (<1%), and Bruce et al[3] (4.4%). Both Goldberg et al[1] and Bruce et al[3] reported a sensory deficit in the lingual nerve in fewer than 1% of patients, a similar finding to our 0.3%.

Conrad et al[5] reported the most comprehensive data on HRQOL outcomes after third molar surgery. Data from those 201 patients are included in our analysis. Immediately after surgery, on postsurgery day 1, more than half of our patients reported their worst pain as severe, but only 20% reported average pain as severe. Ninety-six percent of patients were taking medication for pain on postsurgery day 1. Perhaps the effectiveness of the medications prescribed for pain accounts for the reported difference between "worst" pain and "average" pain. Even though the daily response on the Gracely scales represents only a patient's perception at a single point in time, data from the Gracely scales seem to support this conclusion. On postsurgery day 1, only 13% patients rated their pain as "intense, very intense, extremely intense," and fewer patients, 5%, rated the unpleasantness of pain as "very distressing, intolerable, very intolerable." Surgeons today can prescribe analgesic medications adequate to reduce inflammation and diminish both the unpleasantness and sensory perception of pain during the early recovery period for third molar surgery.

The pattern reported by Conrad et al[5] for delayed recovery for pain measures compared with lifestyle and oral function measures persisted with our data. The median number of days for recovery for "worst" pain (9 days) and "average" pain (8 days) and days to "no meds" (7 days) exceeded the median days to recovery for lifestyle measures (≤4 days) and most oral function measures (≤5 days). Data from the Gracely scales again appeared to clarify the picture. At 7 to 9 days after surgery, less than 5% of patients reported pain as "intense, very intense, extremely intense," and 47% on day 7 and 63% on day 9 indicated that pain intensity was "faint" or "nothing." The median sensory intensity of pain in the same timeframe was rated by the patients as "very weak" to "none." Patients rated unpleasantness of pain even lower than pain intensity on days 7 and 8: fewer than 2% as "very distressing, intolerable, very intolerable." On day 7, more than half of the patients (56%) rated their affective perception of pain as "slightly unpleasant" or "neutral"; median unpleasantness of pain was rated as "slightly unpleasant." Perhaps appropriately taking pain medications throughout the recovery period reduced the "unpleasantness" associated with pain after surgery and prevented pain from affecting resumption of usual lifestyle and oral function.

Savin and Ogden[6] studied selected HRQOL measures after third molar surgery under general anesthesia in 29 patients, analyzing responses on postsurgery days 1 and 7. Social interaction was affected "quite a lot" or "very

much" in more than one third of patients on postsurgery day 7; only 4% of our patients were similarly affected. Lopes et al[7] and Van Gool et al[8] reported that the average number of days before return to work was 3 and 2.5, respectively. Berge and Boe[9] and Berge[10] indicated that 90% patients had returned to work by postsurgery day 3. The issue of work was not addressed in our study, but the median number of days to return to daily activity and social life was 3.

By postsurgery day 7, chewing and resuming a regular diet were affected "little" or "not at all" in more than two thirds of the patients of Savin and Ogden's.[6] Our results were similar, with recovery for chewing and return to a regular diet taking 5 and 7 days, respectively, on average. Talking appears to have been less of a problem for our patients and for those of Savin and Ogden as well. For our patients, surgery interfered with talking for only 1 day; by day 7, 96% of the patients of Savin and Ogden reported little or no problem.

In summary, having both clinical and HRQOL data on recovery after third molar surgery can improve a surgeon's ability to inform prospective patients about what to expect if removal of third molars is elected. Our findings with both clinical and HRQOL outcome data after surgery from the same cohort of patients provide a detailed picture of the typical postsurgery course. Further clinical research must focus on reducing morbidity and improving recovery after third molar surgery in patients whose preoperative clinical conditions would predict a delayed recovery period.

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References

1. Goldberg MH, Nemarich AN, Marco WP: Complications after mandibular third molar surgery: A statistical analysis of 500 consecutive procedures in private practice. J Am Dent Assoc 111:277, 1985
2. Osborn T, Fredrickson B, Small I, et al: A prospective study of complications related to mandibular third molar surgery. J Oral Maxillofac Surg 43:767, 1985
3. Bruce RA, Fredrickson GC, Small GS: Age of patients and morbidity associated with third molar surgery. J Am Dent Assoc 101:240, 1980
4. Shugars DA, Benson K, White RP Jr, et al: Developing a measure of patient perceptions of short-term outcomes of third molar surgery. J Oral Maxillofac Surg 54:1402, 1996
5. Conrad SM, Blakey GH, Shugars DA, et al: Patients' perception of recovery after third molar surgery. J Oral Maxillofac Surg 57:1288, 1999
6. Savin J, Ogden GR: Third molar surgery–A preliminary report on aspects affecting quality of life in the early postoperative period. Br J Oral Maxillofac Surg 35:246, 1997
7. Lopes V, Mumenya R, Feinmann C, et al: Third molar surgery: An audit of the indications for surgery, postoperative complaints and patient satisfaction. Br J Oral Maxillofac Surg 33:33, 1995
8. Van Gool AV, Ten Bosch JJ, Boering G: Clinical consequences of complaints and complications after removal of the mandibular third molar. Int J Oral Surg 6:29, 1977
9. Berge TI, Boe OE: Predictor evaluation of postoperative morbidity after surgical removal of mandibular third molars. Acta Odontol Scand 52:163, 1994
10. Berge TI: Inability to work after surgical removal of mandibular third molars. Acta Odontol Scand 55:64, 1997
11. Gracely RH, Dubner R, McGrath PA: Narcotic analgesia: Fentanyl reduces the intensity but not the unpleasantness of painful tooth pulp sensations. Science 203:1261, 1979
12. Gracely RH, Kwilosz DM: The descriptor scale: Applying psychophysical principles to clinical pain assessment. Pain 35:279, 1988
13. Eklund SA, Pittman JL: Third-molar removal patterns in an insured population. J Am Dent Assoc 132:469, 2001
14. Dworkin SF, Huggins KH, LeResche L, et al: Epidemiology of signs and symptoms in temporomandibular joint disorders: Clinical signs in cases and controls. J Am Dent Assoc 120:273, 1990
15. Raustia AM, Oikarinen KS: Effect of surgical removal of the mandibular third molars on signs and symptoms of temporomandibular dysfunction: A pilot study. J Craniomandib Pract 9:356, 1991