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Patient's perception of recovery following surgical removal of mandibular third molars. A prospective european multi-center study

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ABSTRACT

This study evaluated patient's perception of recovery following surgical removal of mandibular third molars (SRM3s) including analyze of potential risk factors associated with impaired convalescent. Patient related parameters combined with preoperative questionnaires including Modified Dental Anxiety Scale, Oral Health Impact Profile-14, and Decayed, Missing, Filled Teeth index were correlated with questionnaires assessing pain, swelling, trismus, sick leave, social and working isolation, physical appearance, eating and speaking ability, diet variations, sleep impairment, impaired sensation of the lip, chin, and tongue, one month following SRM3s. Totally, 412 patients (223 females, 189 males) with mean age of 29.4 years were included. Treatment satisfaction and willingness to undergo similar surgery were reported by 92% and 95%, although 21% reported that the surgery and postoperative period had been worse than expected. Mean days with pain, sick leave, and swelling were 3.6, 2.1, and 3.6, respectively. Preoperative symptoms, dental anxiety level, and prolonged surgical time were associated with increased pain and swelling ($P < 0.05$). Pell and Gregory classification (I-IIIC) were associated with impaired sensation of the lower lip and chin ($P < 0.05$). Consequently, results from this study improve the surgeon's ability to predict parameters that predisposed to impaired recovery and neurosensory disturbances following SRM3s.

1. Introduction

Surgical removal of mandibular third molars (SRM3s) is a common surgical procedure in dental clinical practice or hospital setting and commonly accompanied by unpleasant sequels such as pain, facial swelling, restricted mouth opening, impaired oral function, alveolar osteitis, and temporary or permanent neurosensory disturbances of the inferior alveolar nerve (Cho et al., 2017; Duarte-Rodrigues et al., 2018; Friscia et al., 2017; Glera-Suárez et al., 2020; Jędrzejewski et al., 2015). Anticipation of intra- and postoperative pain is often the most feared complication by patients prior to SRM3s, which frequently lead to avoidance of consultation, cancellation, or postponement of the

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treatment. Moreover, pain and facial swelling following SRM3s have a substantially adverse effect on oral health-related quality of life (OHRQoL) as well as a negatively impact on working life, social activities, and personal well-being in the immediate postoperative period (Duarte-Rodrigues et al., 2018; Slade et al., 2004). However, pain following SRM3s is a normal physiological response to the tissue damage and usually treated sufficiently by paracetamol, non-steroidal anti-inflammatory drugs, or opioids (Isiordia-Espinoza et al., 2022). The highest pain intensity score is normally reached during the first postoperative days and then gradually decreases during the first week (Bortoluzzi et al., 2011). Increasing age, gender, smoking habits, systemic diseases, body mass index (BMI), oral hygiene level, bone density, difficulty index of the impacted third molar, presence of pericoronitis, length and type of surgery, type of anesthesia, intraoperative complications, surgeon's experience, and contamination of the surgical wound are well-known risk factors that determine the intensity and duration of pain following SRM3s (Aznar-Arasa et al., 2014; Osunde et al., 2014; Bui et al., 2003; Barbosa-Rebellato et al., 2011). Moreover, psychological variables such as preoperative dental anxiety and fear, past dental history, or socioeconomic factors have been reported to amplifies the perceived pain threshold leading to prolonged discomfort and deterioration of OHRQoL following SRM3s (González-Martínez et al., 2017; Lago-Méndez et al., 2006; McGrath et al., 2003; van Wijk et al., 2009). However, patient's perception of recovery is seldomly reported in large patient samples following SRM3s (Beech et al., 2017; Grossi et al., 2007; Shugars et al., 1996). Moreover, conclusions from previous studies assessing the association between patient's perception of recovery following SRM3s and preoperative OHRQoL or dental anxiety level are inconclusive, indicating that impaired convalescent may be influenced by various parameters, which has not been sufficiently elucidated (Aznar-Arasa et al., 2014; Colorado-Bonnin et al., 2006; Conrad et al., 1999; Duarte-Rodrigues et al., 2018; Grossi et al., 2007; Hallab et al., 2022; Negreiros et al., 2012; Onwuka et al., 2020; Phillips et al., 2010; Sato et al., 2009; Snyder et al., 2005; White RP Jr et al., 2003). Consequently, there is a need of studies with a large patient sample assessing potential pre- and intraoperative risk factors associated with impaired convalescent following SRM3s including i.e., patient characteristics, dental anxiety level, OHRQoL, surgical difficulty, and length of surgical procedure. The objective of the present prospective study is therefore to evaluate patient's perception of recovery following SRM3s including an analyze of potential parameters influencing impaired convalescent.

2. Material and methods

2.1. Study design

The present prospective was conducted at 11 European departments of maxillofacial and oral surgery. Patients scheduled for SRM3s between January 1, 2022 until the December 31, 2022 were invited to participate. In each department, included patients were assigned a confidential number, so that anonymity was maintained, and collected data was stored in a systematic computer-assisted database.

2.2. Eligibility criteria

Inclusion and exclusion criteria are outlined in Table 1.

2.3. Data collection

Pre- and intraoperative registrations included clinical and radiographic examination of the impacted third molar combined with self-administrated questionnaires and visual analogue scale (VAS). Preoperative questionnaires were completed immediately before SRM3. Postoperative questionnaires were completed, one month after surgery. Instructions for completing the questionnaires were explained in detail to each patient before the questionnaires were completed by themselves, to prevent being influenced by the surgeons or nurses' opinions and wills.

Table 1
Inclusion- and exclusion criteria.

Inclusion criteria:
• A partially or totally impacted mandibular third molar. • Indication for surgical removal of the mandibular third molar. • Age between 14 and 80.
Exclusion criteria:
• Surgical removal of mandibular third molar in conjunction with other surgical interventions in the oral cavity phrase an upper third molar in the same side. • A surgical procedure or use of specific surgical instruments including piezoelectric surgery, which differs significantly from the described standard procedure in the present protocol. • Concomitant infections and inflammatory symptoms in the oral cavity at the time of surgery. • ASA score 3 or above. • Diminish bone healing capacity due to severe anemia, hypothyroidism, or poor nutrition. • Medication with antiresorptive agents. • Previous radiotherapy for head and neck cancer. • Psychological disease.

2.3.1. Preoperative registration

Preoperative registration included age, gender, smoking habits, medical co-morbidities, alcohol consumption, educational level, work activity, type of preoperative x-ray, preoperative pathology, and symptoms related to the impacted third molar. Moreover, each patient was asked to rate their anxiety level for the surgical procedure using VAS from zero to 100 (0 = not nervous at all; 100 extremely nervous). Preoperative questionnaires included.

- Decayed, Missing, Filled Teeth index (DMFT).
- The Modified Dental Anxiety Scale (MDAS).
- Oral Health Impact Profile-14 (OHIP-14).

DMFT is a valuable index for determining and monitoring the current oral health status. DMFT index calculate the sum of each patients decayed, missing, and filled permanent teeth. All teeth were included and therefore the DMFT index ranges from zero to 32. Each tooth was counted only once, and decayed, even secondary caries, takes precedence over filled teeth/surfaces. The index score was calculated by the following equation:

$$\text{DMFT score} = \text{Decayed teeth} + \text{Missing teeth} + \text{Filled Teeth}$$

MDAS is a brief, self-administered questionnaire rating patient's emotional reaction to an up-coming dental visit. MDAS consist of five questions in a Likert scale ranging from not anxious (scoring 1), slightly anxious (scoring 2), fairly anxious (scoring 3), very anxious (scoring 4) to extremely anxious (scoring 5). The scores are summed together producing a total MDAS score ranging from 5 to 25, with cut-off scores 14 and 19 suggestive of high dental anxiety and dental phobia.

OHIP-14 questionnaire is organized into seven conceptual dimensions including functional limitation, physical pain, psychological discomfort, physical disability, psychological disability, social disability, and handicap (Slade and Spencer, 1994; Slade, 1997). Two items are used to measure each dimension and consequently the questionnaire consists of 14 items. Response format of OHIP-14 are as follows: Very often = 4; Fairly often or many times = 3; Occasionally = 2; Hardly ever or nearly never = 1; Never/I don't know = 0. The OHIP-14 scale ranged from 0 to 56 and dimension score ranged from 0 to 8. The values of the 14 items and each dimension were summed to calculate the OHIP-14 severity score, with higher scores indicating poorer OHRQoL.

2.4. Intraoperative registration

Preoperative intraoral x-ray, panoramic radiograph or CBCT were used to categorize the preoperative position of the mandibular third molar and grade the surgical difficulty level according to Pell and Gregory system (Class IA,B,C; Class IIA,B,C; Class IIIA,B,C). The use of pre- and postoperative analgesic, antibiotic and corticosteroids were also registered as well as length of the surgical procedure from incision to last suture using a stopwatch. Intra- and postoperative complications involving severe bleeding, displacement of roots, intraoperative visualization of the inferior alveolar nerve, infection, alveolar osteitis, temporary or permeant nerve injury of the lingual and inferior alveolar nerve as well as mandibular fracture were also registered.

2.5. Surgical removal of mandibular third molar

The procedure for SRM3 was standardized among the included departments. Initially, an incision was made from the anterior border of the ascending mandibular ramus to the distal part of the second mandibular molar. The mucoperiosteal flap was raised. If necessary, facial and distal bone around the impacted third molar was removed with burs under saline irrigation. If necessary, the third molar was sectioned with burs before the tooth was elevated. The extraction socket and surround bone were rinsed with saline and cleaned before suturing. Postoperative instruction and analgetic were provide to all patients.

2.6. Postoperative assessment after one month

Convalescent was evaluated by self-administrated questionnaires assessing patient's perception of pain, facial swelling, restricted mouth opening, social and working isolation, physical appearance, eating and speaking ability, diet variations, sleep impairment, duration of the OHRQoL alterations and discomfort as well as questions whether they would undergo similar treatment again, if needed or if they would recommend this treatment to a friend or a relative, if indicated. Response format was yes/no or evaluated by means of a four-point Likert-type rating scale including Not at all = 0; close to normal = 1; almost normal = 2; a little = 3. The rating score was calculated, and higher scores indicated poorer patient recovery. The self-administrated questionnaire also examined how many days patients have been on sick leave or been off work, had eating and speech difficulties, and how long their sleep and physical activity have been affected. The questionnaires are supplemented by VAS (0 = none to 100 = maximum) assessing pain, social and working isolation, eating and speaking ability, sleep impairment, and impaired sensation of the lower lip, chin, and tongue.

2.7. Data management and statistical analysis

Data collection was conducted by an appointed investigator at each department and inserted to the provide excel sheets ensuring systematic recording of data. Baseline measurements were obtained preoperatively (T0) and correlated with postoperative assessment after one month (T1), respectively. Data management and analysis was conducted using SPSS statistical software (SPS Inc., US). Descriptive statistics were reported by mean, standard deviation, and range. Patient's perception of recovery was correlated with OHIP-14 and MDAS using Spearman's rank correlation coefficient. Association between OHIP-14 score at enrolment and patient's perception of recovery was analyzed by dichotomizing OHIP-14 score into two groups (<10 or ≥ 10) using bootstrapped *t*-test (10,000 replications and accelerated bias-corrected CI). Correspondingly, the association between MDAS score at enrolment and patient's perception of recovery was analyzed by dichotomizing MDAS score into two groups (<19 or ≥ 19). Risk ratio (RR) and 95% confidence interval (CI) are reported for the correlation analyze. Level of significance was $P < 0.05$.

3. Results

3.1. Preoperative

A total of 412 patients (223 females, 189 males) were included (Fig. 1). Mean age at surgery was 29.37 ± 2.59 years (range: 14–76). Voluptuary habits, medical co-morbidities, educational level, and work activity are outlined Table 2. SRM3 was performed in the left (52%) or right side (48%) of the mandibel without significantly difference ($P > 0.05$). The preoperative impaction of the third molar according to Pell and Gregory classification is outline in Table 3. The preoperative dental status was good (71%), moderate (25%), or poor (4%). The mean DMFT index was 6.42 ± 4.94 (range: 0–32). Preoperative radiographs examination included intraoral (1%), orthopantomography (80%), or cone beam computed tomography (19%). Preoperative symptoms included pain (46%), periodontal disease (12%), swelling (11%), infection (10%), caries (3%), restricted mouth opening (1%), paresthesia (1%), or no symptoms (16%). Preoperative pathology included pericoronitis (20%), odontogenic cyst (7%), pulpitis (1%), or no pathology (72%). The mean MDAS score was 11.0 ± 4.16 (range: 0–25). Distribution of gender, age, and dental anxiety level according to MDAS is outlined in Table 4. Patients preoperatively anxiety level score for the surgical procedure was 45.0 ± 27.7 (range: 0–100). Preoperative OHIP-14 scores are outline in Table 5. Psychological discomfort and physical pain revealed highest dimension scores. Pre- and postoperative medication is outlined in Table 6.

3.2. Intraoperative

SRM3s were conducted by residents and experienced maxillofacial surgeons, respectively. The mean time length of the surgical procedure was 25.0 ± 11.5 min (range: 5–75) (Fig. 2). No intraoperative complications were observed in most of the patients (93%), while bleeding (0.5%), visualization of the inferior alveolar nerve (3%) or root apex fracture (0.5%) were rarely observed.

3.3. Postoperative

No postoperative complications were observed in most patients, while continuous bleeding (1%), alveolar osteitis (4%), abscess (1%), or prolonged restricted mouth opening (1%) were infrequently observed. Impaired sensation of the lower lip, chin, and tongue were reported by 13%, 10%, and 6% of the patients, one month following SRM3 (Table 7). The mean impaired sensation of the lower lip was 42.0 ± 27.9 (range: 0–95) as evaluated by VAS (0 = no sensation at all; 100 = normal sensation). Corresponding values for the chin and tongue were 45.0 ± 27.4 (range: 0–90), and 43.0 ± 23.8 (range: 0–90), respectively.

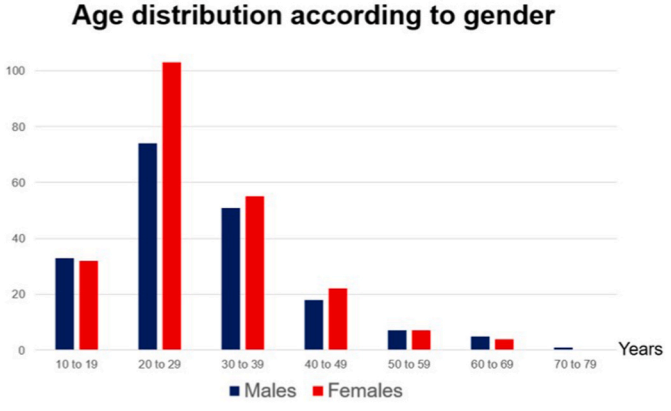

Fig. 1. Age distribution among the included patients (no.: 412) according to gender.

Table 2
Patient demographic.

Voluptuary habits:
• No voluptuary habits (72%)
• Smoking habits (21%)
• Alcohol (5%)
• Alcohol and smoking (2%)
Medical co-morbidities:
• No medical co-morbidities (91%)
• Heart diseases (3%)
• Diabetes (2%)
• Allergy (1%)
• Arthritis (1%)
• Psychological or psychiatric disturbances (1%)
• Breast cancer (1%)
Educational level:
• Elementary school (8%)
• High school (39%)
• University (53%)
Work activity:
• Student (36%)
• Household (4%)
• Worker (56%)
• Unemployed (4%)

Table 3
Pell and Gregory classification.

IA (8%)	IB (14%)	IC (8%)
IIA (7%)	IIB (29%)	IIC (17%)
IIIA (3%)	IIIB (3%)	IIIC (13%)

Table 4
Modified Dental Anxiety Scale according to dental anxiety level.

Total MDAS	Patients Number/ percentage	Mean age (years)	*P*-value	Male/female ratio	*P*-value
0–18	393 (95%)	29.2	P > 0.05	0.86:1	P > 0.05
19–25	19 (5%)	31.9		0.58:1	

Responses of the self-administrated questionnaires assessing patient's perception of recovery following SRM3 are outlined in Tables 8–10. Satisfaction with the treatment was reported by 92% of the patients, 84% would recommend the treatment, and 95% would repeat the treatment. Moreover, 97% of the patients described that the problem causing symptoms has been solved. However, 21% of the patients described that the surgery and the postoperative period had been worse than expected. The average number of days with pain was 3.7 ± 3.0 (range: 0–20). No pain was described by 12% of the patients, while patients experiencing postoperative pain reported 4.2 ± 2.9 (range: 1–20) days with pain, and more pain than expected were described by 28%. The average number of days with sick leave or been off work was 2.07 ± 2.75 (range: 0–14), while patients experiencing postoperative pain reported 4.15 ± 2.57 (range: 1–14) days with sick leave or been off work. The average number of days with facial swelling was 3.6 ± 2.7 (range: 0–30). No facial swelling was described by 14% of the patients, while patients experiencing postoperative swelling reported 4.2 ± 2.7 (range: 1–30) days with swelling, and more swelling than expected were reported by 30%. Restricted mouth opening was reported by 85% of the patients, and severely restricted mouth opening was reported by 21.4%.

3.4. Correlation analysis

There was no significant correlation between gender and postoperative pain, facial swelling, sick leave or been off work, social and working isolation, physical appearance, eating and speaking ability, diet variations, sleep impairment, and postoperative discomfort ($P > 0.05$). Moreover, no significant correlation between older age and postoperative pain, facial swelling, and sick leave request was identified ($P > 0.05$), whereas a significant correlation between older age and reduced social activities was revealed ($P < 0.05$; CI: 1.2–2.6; RR: 1.75).

There was no significant correlation between smoking habits and postoperative pain, facial swelling, and sick leave request ($P > 0.05$).

There was no significant correlation between DMTF values, side of the mandibel, Pell and Gregory classification and postoperative pain, facial swelling, sick leave or been off work, social and working isolation, physical appearance, eating and speaking ability, diet variations, sleep impairment, and discomfort ($P > 0.05$).

There was no significant correlation between pre- and postoperative analgetika, antibiotic or corticosteroids and postoperative pain, facial swelling, sick leave, social and working isolation, physical appearance, eating and speaking ability, diet variations, sleep impairment, and discomfort ($P > 0.05$).

There was a significant correlation between presence of preoperative symptoms related to the third molar and increased postoperative pain ($P < 0.001$; CI: 2.4–5.6; RR: 3.6), facial swelling ($P < 0.005$; CI: 1.4–3.2; RR: 2.1), and diminished social activities ($P < 0.05$; CI: 1.1–3.6: 2.0).

There was a significant correlation between presence of preoperative dental anxiety and increased postoperative pain ($P < 0.05$; CI: 1.2–2.4; RR: 1.8), facial swelling ($P < 0.001$; CI: 1.7–5.8; RR: 3.1), and diminished social activities ($P < 0.05$; CI: 1.0–2.3; RR: 1.5).

There was a significant correlation between prolonged surgical time and increased postoperative pain ($P < 0.005$; CI: 1.3–2.9; RR: 1.9), and facial swelling ($P < 0.005$; CI: 1.4–4.6; RR: 2.6).

There was a significant correlation between Pell and Gregory classification (IC, IIC, and IIIC) and impaired sensation in the lower lip ($P < 0.05$; CI: 1.8–3.9; RR: 2.1), and chin ($P < 0.05$; CI: 1.3–4.7; RR: 2.4). Moreover, prolonged surgical time was significantly correlated with impaired sensation in the lower lip ($P < 0.05$; CI: 1.1–3.8; RR: 2.0).

Correlation between impaired OHRQoL (OHIP-14 score ≥10) at enrolment and patient's perception of recovery is outlined in Table 11. There was no significant correlation between impaired OHRQoL at enrolment and impaired sensation in lower lip, chin, and tongue as well as number of days on sick leave or been off work, cancellation of activities, changes in physical appearances, eating or speech difficulties, restricted mouth opening, or sleep impairment ($P > 0.05$), whereas a significant correlation in perception of taste and chewing ability was identified ($P < 0.05$). Correlation between dental anxiety level (MDAS score ≥19) at enrolment and patient's perception of recovery is outlined in Table 12. There was no significant correlation between dental anxiety level at enrolment and impaired sensation in lower lip, chin, and tongue as well as number of days on sick leave or been off work, cancellation of activities, perception of taste, restricted mouth opening, speech difficulties, or sleep impairment ($P > 0.05$), whereas a significant correlation in changes in physical appearances, eating difficulties, and chewing ability was identified ($P < 0.05$).

4. Discussion

Patient's perception of recovery following SRM3s including an analyze of potential parameters influencing impaired convalescent was evaluated in this prospective European multi-center study using questionnaires and VAS, after one month. Postoperative discomfort comprising pain, facial swelling, and sick leave or been off work lasted on average between 2 and 4 days. High treatment satisfaction and willingness to undergo similar surgery were reported by most patients. Preoperative symptoms related to the impacted third molar, dental anxiety, and prolonged surgical time were significantly associated with increased postoperative pain, facial swelling, and diminished social activities. Pell and Gregory classification (I-IIIC) were significantly associated with impaired sensation of the lower lip and chin and prolonged surgical time was significantly associated with impaired sensation of the lower lip.

Table 5
Distribution of responses to each question of OHIP-14 questionnaire.

	Question	Preoperative Oral Health Impact Profile-14 scores prior to surgical removal of mandibular third molar						
		Enrolment						
		0	1	2	3	4	Total	Mean
Functional limitation	Have you had trouble pronouncing any words because of problems with your teeth, mouth or dentures?	359	44	6	3	0	65	0.16
	Have you felt that your sense of taste has worsened because of problems with your teeth, mouth or dentures?	294	86	27	5	0	155	0.38
Physical pain	Have you had painful aching in your mouth?	85	123	163	38	3	575	1.39
	Have you found it uncomfortable to eat any foods because of problems with your teeth, mouth or dentures?	120	142	117	29	4	479	1.16
Psychological discomfort	Have you been self-conscious because of your teeth, mouth or dentures?	99	119	118	60	16	599	1.45
	Have you felt tense because of problems with your teeth, mouth or dentures?	122	257	227	94	25	1093	1.20
Physical disability	Has your diet been unsatisfactory because of problems with your teeth, mouth or dentures?	215	111	66	16	4	307	0.74
	Have you had to interrupt meals because of problems with your teeth, mouth or dentures?	210	120	67	15	0	299	0.72
Psychological disability	Have you found it difficult to relax because of problems with your teeth, mouth or dentures?	176	142	76	16	2	350	0.85
	Have you been a bit embarrassed because of problems with your teeth, mouth or dentures?	195	102	84	28	3	366	0.89
Social disability	Have you been a bit irritable with other people because of problems with your teeth, mouth or dentures?	225	122	50	14	1	268	0.65
	Have you had difficulty doing your usual jobs because of problems with your teeth, mouth or dentures?	225	116	61	9	2	273	0.65
Handicap	Have you felt that life in general was less satisfying because of problems with your teeth, mouth or dentures?	200	115	79	11	7	334	0.81
	Have you been totally unable to function because of problems with your teeth, mouth or dentures?	347	41	18	5	1	96	0.52
		Mean OHIP-14 score for all items: 376 0.83						

OHIP-14, Oral Health Impact Profile-14.
0 = never; 1 = hardly ever or nearly never; 2 = occasionally; 3 = fairly often or many times; 4 = very often.

Table 6
Pre- and postoperative medication.

Medication	Preoperative	Postoperative
Analgetica:	19%	0%
Ketoprofen	7%	10%
Ibuprofen	6%	14%
Paracetamol	3%	11%
Nimesulid	3%	31%
Ibuprofen and paracetamol	3%	3%
Metamizole	3%	3%
Midazolam	1%	0%
Caffetin	0.4%	0%
Diclofenac	0.2%	7%
Naproxen	0.2%	0.4%
Etoricoxib	0%	6%
Dexketoprofen/metamizole	0%	5%
Dexketoprofen	0%	3%
Dexketoprofen/paracetamol	0%	1%
No analgetic	57%	6%
Antibiotic:		
Amoxicillin/clavulante	5%	23%
Amoxicillin	3%	32%
Clindamycin	0.4%	0.7%
Ceftriaxone	0.2%	4%
Doxycycline	0.2%	1%
Cefuroxime	0%	3%
Azythromiycin	0%	0.2%
No antibiotic	91%	36%
Corticosteroid:		
Dexamethasone	0%	13%
Prednisolone	0%	4%
Bethametasone	0%	0.2%
Deflazacort	0%	0.2%
No corticosteroid	100%	83%

The present European multi-center study involved a large patient cohort, and the results seem to be generalizable since the surgeries was performed by various surgeons with different surgical skills. However, the present study is also characterized by various limitations including

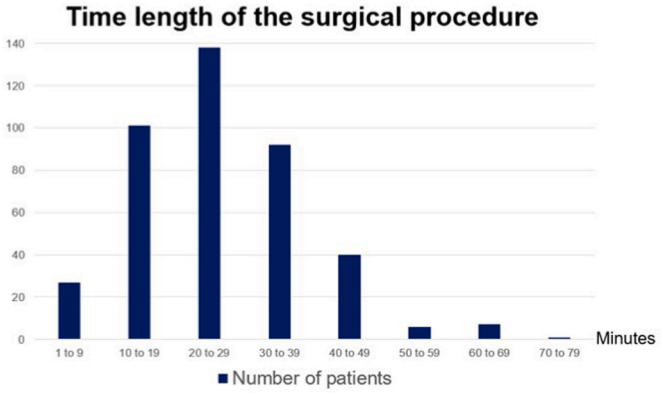

Fig. 2. Length of surgical time following surgical removal of mandibular third molar among the included patients (no.: 412).

Table 7
Questionnaire assessing sensitivity of the lip, chin, and tongue.

Question	Questionnaire following surgical removal of mandibular third molar	
	Yes	No
Impaired sensation of the lower lip, chin, and tongue:		
Have you noticed decreased sensitivity in your lip after surgery?	13%	87%
Have you noticed decreased sensitivity in your chin after surgery?	10%	90%
Have you noticed decreased sensitivity in your tongue after surgery?	6%	94%

Table 8
Questionnaire assessing pain, facial swelling, general condition, social and working isolation, physical appearance, and quality of life alterations.

Question	Questionnaire following surgical removal of mandibular third molar	
	Yes	No
Pain:		
Did you feel pain after surgery?	88%	12%
Did you feel more postoperative pain then expected?	28%	72%
Facial swelling:		
Were you swollen after surgery?	86%	14%
Were you more swollen then expected?	30%	70%
General condition:		
Did you feel changes in your mood?	37%	63%
Did you feel malaise?	34%	66%
Social isolation:		
Did you keep your usual social activities?	46%	54%
Have you continued practicing your favorite sport or hobbies?	42%	58%
Working isolation:		
Did you ask for sick leave or discontinue your work?	50%	50%
Did the surgery affect your performance at work?	40%	60%
Did anyone accompany you or drive you to work due to surgery?	36%	64%
Has this person discontinued his/her work to do so?	34%	66%
Physical appearance:		
Have you noticed changes in your physical appearance?	38%	62%
Is it what you expected?	61%	39%
Has it been worse than expected?	21%	79%
Has it been better than expected?	46%	54%
Mean duration of the quality-of-life alterations:		
Are you satisfied with the treatment?	92%	8%
Would you recommend the treatment?	84%	16%
Would you repeat the treatment?	95%	5%
Do you feel that the problem causing you symptoms has been solved?	97%	3%

Table 9
Questionnaire assessing eating ability, diet, speaking ability, and sleep impairment.

Question	Questionnaire following surgical removal of mandibular third molar			
	0	1	2	3
Eating ability and diet variations:				
Did you continue with your usual diet?	22.3%	33.2%	18.0%	26.5%
Did you notice any changes in the perception of taste?	85.5%	13.3%	0.5%	0.7%
Did you notice any changes in chewing ability?	22.2%	55.8%	16.7%	5.3%
Did you have problems opening your mouth?	15.0%	63.6%	17.5%	3.9%
Speaking ability noticed:				
Have you notice any changes in voice?	85.2%	13.8%	0.2%	0.8%
Have you notice any changes in your ability to speak?	76.0%	22.6%	1.0%	0.4%
When you talk with other people, do they understand you?	11.4%	5.6%	13.1%	69.9%
Sleep impairment:				
Have you had problems falling asleep?	67.7%	28.4%	3.9%	0.0%
Have you experienced interruptions in your sleep?	62.2%	31.3%	5.3%	1.2%
Have you felt drowsy?	76.6%	27.7%	0.7%	0.0%

0 = not at all; 1 = a little; 2 = quite a lot; 3 = very much.

Table 10
Questionnaire assessing days of recovery.

Question	Number of patients with symptoms	Questionnaire following surgical removal of mandibular third molar
		Mean ± SD, (range)
Decreased sensitivity of the lip on VAS (0 = no feeling, 100 = normal feeling)	52	42.0 ± 27.9, (0–95)
Decreased sensitivity of the chin on VAS (0 = no feeling, 100 = normal feeling)	42	45.0 ± 27.4, (0–90)
Decreased sensitivity of the tongue on VAS (0 = no feeling, 100 = normal feeling)	42	43.0 ± 23.8, (0–90)
Number of days on sick leave or been off work?	206	4.15 ± 2.57, (1–14)
Number of days with cancellation of activities after surgery?	233	4.0 ± 2.3, (1–20)
Number of days with cancellation of sports or hobbies after surgery?	240	5.6 ± 3.1, (1–20)
Number of days with changes in physical appearance?	298	3.4 ± 2.9, (1–30)
Number of days with eating difficulties?	320	3.6 ± 2.9, (1–20)
Number of days with changes in perception of taste?	60	0.5 ± 2.3, (1–30)
Number of days with changes in chewing ability?	321	3.2 ± 3.2, (1–18)
Number of days with restricted mouth opening?	350	3.3 ± 3.1, (1–14)
Number of days with speech difficulties?	61	0.5 ± 1.1, (0–10)
Number of days your sleep has been affected?	133	1.0 ± 1.9, (1–10)

VAS, visual analogue scale.

solely collecting postoperative information's corresponding to one month, most of the patients were between 20 and 29 yeas causing selection bias, the experience of the surgeon was not registered, complications were not were not categorized according to the Clavien-Dindo classification (Clavien et al., 1992), no standardization of analgetic, antibiotic, corticosteroids or postoperative instructions as well as no systematic registration of oral hygiene, BMI, quantity or period of need for analgesics, antibiotic, or corticosteroids were performed. Moreover, correlation between patient's perception of recovery and socioeconomic status or educational background were not assessed. Conclusions drawn from the results of this European multi-center study should therefore be interpreted with caution.

Postoperative pain is generally considered the main patient concerns following SRM3. Pain is caused by the immediate physiological inflammatory response to the tissue injury and usually reaches the highest intensity within the first 24 h postoperatively and gradually resolves during the first week (Bortoluzzi et al., 2011), which is in accordance with the results of the present study. However, pain can cause substantial discomfort and prolong the period of convalescent and sick leave. Previous studies have demonstrated that the average number of days before returning to work varied between 2 and 3 days following SRM3s (Berge, 1997; Colorado-Bonnin et al., 2006; White et al., 2003). In the present study, the average number of days with sick leave or been off work was 2.07 days, while patients experiencing postoperative pain reported 4.15 days. Consequently, adequate postoperative pain management is essential to improve convalescent and shorten the period of sick leave or been off work following SRM3s.

The severity of postoperative pain following SRM3s are influenced by patient-related parameters including age, gender, dental anxiety, smoking habits, systemic diseases, BMI, oral hygiene level, and impaction pattern of the third molar (Qiao et al., 2022; Xu and Xia, 2020). Moreover, SRM3s are reported to be more complicated in anxious patients (Aznar-Arasa et al., 2014). In the present study, dental anxiety level and preoperative symptoms related to the third molar were significantly associated with increased postoperative pain, whereas gender, Pell and Gregory classification, DMFT index, or smoking habits

Table 11
Association between OHIP-14 at enrolment and patient's perception of recovery.

Question	Questionnaire following surgical removal of mandibular third molar		
	OHIP-14 score <10 (no.: 187) Mean ± SD	OHIP-14 score ≥10 (no.: 225) Mean ± SD	*P*-value
Number of patients with decreased sensitivity of the lip	1	2	P > 0.05
Number of patients with decreased sensitivity of the chin	1	2	P > 0.05
Number of patients with decreased sensitivity of the tongue	0	3	P > 0.05
Number of days on sick leave or been off work?	2.22 ± 5.80	1.96 ± 2.90	P > 0.05
Number of days with cancellation of activities after surgery?	2.15 ± 4.90	2.26 ± 2.90	P > 0.05
Number of days with cancellation of sports or hobbies after surgery?	2.95 ± 3.60	3.53 ± 3.20	P > 0.05
Number of days with changes in physical appearance?	3.31 ± 3.20	3.40 ± 2.60	P > 0.05
Number of days with eating difficulties?	4.03 ± 3.20	3.19 ± 2.90	P > 0.05
Number of days with changes in perception of taste?	0.22 ± 3.00	0.62 ± 1.43	P < 0.05*
Number of days with changes in chewing ability?	2.72 ± 2.60	3.66 ± 3.60	P < 0.05*
Number of days with restricted mouth opening?	3.49 ± 3.40	3.09 ± 2.90	P > 0.05
Number of days with speech difficulties?	0.44 ± 1.20	0.45 ± 1.10	P > 0.05
Number of days your sleep has been affected?	1.18 ± 2.10	0.76 ± 1.60	P > 0.05

OHIP-14.
*Statistically significant.

Table 12
Association between the Modified Dental Anxiety Scale at enrolment and patient's perception of recovery.

3%Question	Questionnaire following surgical removal of mandibular third molar		
	MDAS score <19 (no.: 393)Mean ± SD	MDAS score ≥19 (no.: 19)Mean ± SD	*P*-value
Number of patients with decreased sensitivity of the lip	2	1	P > 0.05
Number of patients with decreased sensitivity of the chin	2	1	P > 0.05
Number of patients with decreased sensitivity of the tongue	2	0	P > 0.05
Number of days on sick leave or been off work?	2.22 ± 5.80	2.58 ± 2.90	P > 0.05
Number of days with cancellation of activities after surgery?	2.15 ± 2.70	3.26 ± 3.30	P > 0.05
Number of days with cancellation of sports or hobbies after surgery?	3.22 ± 3.60	4.31 ± 3.90	P > 0.05
Number of days with changes in physical appearance?	3.31 ± 2.90	5.31 ± 2.70	P < 0.05*
Number of days with eating difficulties?	3.48 ± 1.50	5.47 ± 3.10	P < 0.05*
Number of days with changes in perception of taste?	0.53 ± 1.30	0.47 ± 1.60	P > 0.05
Number of days with changes in chewing ability?	3.08 ± 1.30	4.68 ± 3.60	P < 0.05*
Number of days with restricted mouth opening?	3.19 ± 1.30	4.79 ± 3.38	P > 0.05
Number of days with speech difficulties?	0.44 ± 1.20	0.63 ± 1.00	P > 0.05
Number of days your sleep has been affected?	0.96 ± 1.20	0.74 ± 1.20	P > 0.05

MDAS, Modified Dental Anxiety Scale.
*Statistically significant.

revealed no significant correlation with increased postoperative pain. Identification of patient-related parameters prior to SRM3s is thus beneficial to implement prophylactic measures to improve convalescent. Application of advanced platelet-rich fibrin in the extraction socket, conscious sedation, submucosal injection of opioids or corticosteroids have demonstrated improved recovery and diminish pain following SRM3, as reported in systematic reviews (Gonçalves et al., 2022; O'Hare et al., 2019; Melini et al., 2020; Ramos et al., 2022). Consequently, these pharmacological therapies may therefore be considered in patients with risk of increased pain.

The severity of postoperative pain following SRM3s is also influenced by the depth of third molar impaction, length of surgical time, and the surgeon's experience (Alvira-González et al., 2017; Aznar-Arasa et al., 2014). Previous studies have demonstrated that the surgical difficulty of third molar surgery is associated with impaired convalescent (Alvira-González et al., 2017; Aznar-Arasa et al., 2014). Prolonged surgical time and deep impaction of the third molar indicate higher surgical difficulty. In the present study, prolonged surgical time and Pell and Gregory classification (I-IIIC) were significantly associated with increased postoperative pain, facial swelling, and diminished social activities. Consequently, the results of the present study thus support that surgical difficulty and prolonged surgical time is associated with impaired convalescent.

Previous studies have demonstrated that the incidence of temporary and permanent impaired sensation of the lip, chin, and tongue varies between 0 and 22% following SRM3s (Leung and Cheung, 2011; Smith, 2013; Kang et al., 2020). The risk of inferior alveolar nerve deficits is significantly associated with the depth of third molar impaction, intimate contact between the third molar and the mandibular canal, intra-operative nerve exposure, and surgeon's experience, as documented in a recent systematic review (Kang, et al., 2020). In the present study, impaired sensation of the lower lip, chin, and tongue were described by 13%, 10%, and 6% of the patients, one month following SRM3s. The impaired sensation of the lower lip and chin were significantly associated with the depth of third molar impaction according to Pell and Gregory classification (I-IIIC) and prolonged surgical time. Consequently, the results of the present study thus support that depth impaction of the third molar is associated with increased risk of nerve deficits, although the incidence of permanent nerve deficits is unknown due to the short observation period. Nevertheless, alternative treatment options like coronectomy may therefore be considered for deeply impacted third molars with high risk of nerve injury to minimize the risk of temporary and permanent nerve deficit (Long et al., 2012).

Patient's perception of recovery following SRM3s is influenced by presurgical expectations, previous dental history, psychologic well-being, and levels of distress (Astramskaitė et al., 2016; González-Martínez et al., 2017). Impaired convalescent due to psychosocial parameters predispose with the perception of OHRQoL and patient's ability to perform their usual activities of daily life following SRM3s (Abramovitz et al., 2021; Duarte-Rodrigues et al., 2018). In the present study, there was no consistent significant correlation between impaired convalescent and dental anxiety level or OHIP-14 score at enrolment indicating that preoperative OHRQoL and dental anxiety level seems not to influence convalescent following SRM3s.

5. Conclusions

Within the limitations of this prospective study, it seems that SRM3s is associated with high treatment satisfaction and a relatively short period of discomfort. Preoperative symptoms related to the third molar, high dental anxiety, and prolonged surgical time caused increased

postoperative pain and facial swelling. Deep impaction of the third molar and prolonged surgical time increased the risk of nerve deficit. These results improve the surgeon's ability to predict which parameters that predisposed to impaired recovery and neurosensory disturbances following SRM3s.

Ethical approval and consent to participate

Not relevant.

Availability of supporting data

Study protocol and all data are available from the corresponding author on reasonable request.

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Authors' contributions

Conception and design of study: TSJ and PC. Surgery: all authors. Acquisition of data: all authors. Analysis of data: PC and TSJ. Drafting of article: TSJ and PC. Critical revision: all authors. Final approval of manuscript: all authors.

Declaration of competing interest

All authors declare no financial interest or conflict of interest, either directly or indirectly, in the products or information listed in the article.

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