Int. J. Oral Maxillofac. Surg. 2016; 45: 1652–1657
http://dx.doi.org/10.1016/j.ijom.2016.08.004, available online at http://www.sciencedirect.com

International Journal of Oral & Maxillofacial Surgery

Clinical Paper
Oral Surgery

Changes in heart rate during third molar surgery

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M. H. J. Hollander, J. Schortinghuis, A. Vissink: Changes in heart rate during third molar surgery. Int. J. Oral Maxillofac. Surg. 2016; 45: 1652–1657.

Abstract. Anxiety is an undesirable psychological phenomenon. Patients are usually anxious when subjected to third molar surgery, but the pattern of anxiety is unknown. The aim of this study was to assess the intensity and course of anxiety during third molar surgery. This study included 48 consecutive patients (mean age 25 ± 6 years) who had a third molar removed surgically under local anaesthesia. The heart rate was monitored continuously during treatment as a measure of anxiety. Preoperative anxiety was scored with the Modified Dental Anxiety Scale. Each patient's anxiety level was assessed when in the waiting room, sitting down in the dental chair, during the application of local anaesthesia, application of surgical drapes, time-out procedure, incision, alveolotomy, removal of the third molar, and suturing, and at the end of the procedure. The lowest heart rates were recorded in the waiting room, in the dental chair, during anaesthesia, when applying surgical drapes, during suturing, and at the end of the procedure. The highest values were obtained during the time-out procedure, incision, and alveolotomy ($P < 0.005$). In conclusion, the intensity and course of anxiety has a specific pattern during third molar surgery, with the lowest levels of anxiety prior to surgery and directly postoperative and the highest during the time-out procedure and the actual surgery.

Key words: anxiety; third molar; heart rate; maxillofacial surgery.

Accepted for publication 8 August 2016
Available online 27 August 2016

Moderately to highly anxious patients experience more intense and prolonged postoperative pain and higher psychological co-morbidity when subjected to surgery.[1–3] Amongst the many variables that affect the threshold for pain, anticipation and anxiety have been reported to be the most important.[4]

Numerous procedures have been shown to provoke anxiety, such as sigmoidoscopy, colposcopy, percutaneous coronary interventions, and cardiac surgery.[5–8] Anxiety most often peaks prior to the procedure and decreases immediately after the procedure. Whether this pattern also applies to oral surgery, e.g., removal of a third molar, is not yet known, although it has been reported that oral surgery is linked to specific and intensive fear.[2,9–11] Furthermore, about 50% of patients are anxious about dental treatment. A visit to the dental clinic provokes feelings of anxiety,[12] and increases blood pressure and heart rate.[13,14]

Anxiety assessments have indicated a higher level of treatment anxiety for oral and maxillofacial surgery than for dental treatment.[15] Therefore, the results of dental studies cannot be translated directly to oral and maxillofacial practice. The course of anxiety throughout the process of third molar removal has not been evaluated thoroughly.[16–18] Therefore, the aim of this study was to assess the intensity and course of anxiety during oral and maxillofacial surgery treatments. This was done by measuring real-time heart rate changes before, during, and after the surgical removal of a third molar, as well as measuring the accompanying fear with the Modified Dental Anxiety Scale (MDAS). Detailed knowledge of the level and

course of anxiety accompanying surgical third molar removal may help in identifying anxiety-reducing interventions.

Materials and methods

Patients

All consecutive patients seen during a 6-week period who were scheduled for the removal of a third molar under local anaesthesia and who were eligible when assessed against the study inclusion and exclusion criteria, were asked to join the study. Inclusion criteria encompassed patients with an indication for the removal of a lower third molar under local anaesthesia, aged between 18 and 40 years, and who were fluent in the Dutch language (to be able to complete the questionnaire). Exclusion criteria were a third molar removal or other oral or maxillofacial procedure within the past 6 months, medical conditions and the use of medications that may induce alterations in heart rate, and patients with an implanted pacemaker or implantable cardioverter defibrillator (ICD).

Study design

Ten minutes before surgery, the preoperative dental anxiety level (situation-specific trait anxiety) was estimated using the validated Dutch version of the MDAS.[19–23] The MDAS consists of five questions, each with a five-category rating scale ranging from 'not anxious' to 'extremely anxious'. Patients rated their emotional reaction during the anticipation of an appointment at the dental clinic, when in the waiting room, and in anticipation of drilling, scaling, and local anaesthetic injection. Responses were scored from 1 to 5, providing total scores ranging from 5 (not anxious at all) to 25 (extremely anxious). Dental anxiety scores of 19 or higher were considered as indicative of high dental trait anxiety.[19,26]

After completing the questionnaire, the patient's heart rate was recorded continuously until the end of the procedure using a Mio Alpha watch (Mio Alpha; Mio Global Physical Enterprises Inc., Vancouver, British Columbia, Canada), a watch with an accuracy comparable to the accuracy of an electrocardiogram (ECG).[24] The real-time heart rate data were transmitted to a Bluetooth Smart Android operated pad. The electronics of the Alpha Mio watch are integrated into the back plate of the wristband and include an accelerometer enabling electro-optical cells to detect the pulsing volume of blood flow (photoplethysmography).

The study was approved by the hospital medical ethics commission. Informed consent was obtained from all patients prior to the study.

Pre-surgical procedure

All consecutive patients who were eligible after application of the inclusion/exclusion criteria were asked to participate when they were scheduled for surgery. After obtaining informed consent, each patient had to complete the MDAS questionnaire, and demographic data were recorded (age, sex, medical history, use of medication, etc.). Next, the patient's heart rate was measured using the continuous heart rate monitor. A Bluetooth link was established with an android tablet using the Bluetooth Low Energy heart rate monitor application (BLE Heart Rate Monitor; Pribble Software LLC, Germantown, Maryland, USA). This monitored and recorded the heart rate every second. The application recorded how much time had elapsed since the start of the heart rate measurements. The time elapsed was also scored on a form and was kept during the various stages of the surgical procedure. These stages were the moment the patient took a seat in the waiting room, when sitting down in the dental chair, the moment of application of local anaesthesia, application of the surgical drapes over the patient's face, time-out procedure, moment of incision, alveolotomy, removal of the third molar, suturing, and the end of the procedure (Table 1). After the patient had been connected to the heart rate monitor, the patient returned to his/her seat in the waiting room where they had to wait for at least 5 min. Subsequently, the patient was accompanied to the operating room and settled in the dental chair. The patient received routine verbal information and reassurance from the operating surgeon.

Surgical procedure

The two senior oral and maxillofacial surgeons were familiar with the aim of this study. The surgical procedure was standardized. In short, the surgical field was anaesthetized by mucosal infiltration and blocking of the inferior alveolar nerve with two to three carpules of local anaesthetic (40 mg articaine hydrochloride per millilitre (4%), with 0.01 mg epinephrine; 1.7 ml per carpule). After local anaesthesia, the surgical field was isolated with sterile drapes, leaving the patient's nose and mouth exposed. The time-out protocol followed, which consisted of the verification of the patient's identity and the aim of the procedure. This time-out procedure is a 'second time' time-out procedure. In the study clinic, the patient's data are checked as soon as the patient is called in from the waiting room. After checking the anaesthetic state of the mucosa, the surgeon made an incision and created a mucoperiosteal flap. After alveolectomy, when necessary, the third molar was removed and the flap was repositioned and sutured. After surgery, routine postoperative instructions, including the use of ibuprofen, were provided to the patient. Subsequently, the Mio Alpha watch was disconnected.

Statistical analysis

A power analysis with a power of 90% and a two-sided significance level of 0.005 was used (with 10 tests as the primary outcome, for the 10 time periods; see Table 1). The significance level of 0.005 was used because the Bonferroni correction was necessary, as 10 tests were used as the primary outcome. Calculations of the sample size were based on paired-samples *t*-tests, in which a non-parametric analysis was taken into account by adding 10% to the total sample size. Sample size calculations were performed using SamplePower 2.0 (SPSS Inc., Chicago, IL, USA).

Table 1. Description of the heart rate measurement time periods.

Period	Measurement time point
1	In the waiting room
2	In the dental chair
3	During local anaesthesia
4	During the application of surgical drapes
5	During the time-out procedure
6	During incision
7	During alveolotomy
8	During removal of the third molar
9	During suturing
10	At the end of the procedure
Pain	During pain
Additional anaesthetics	During the administration of additional anaesthesia