Correlation between Body Mass Index and the Occurrence of Postoperative Complications after Surgical Removal of the Lower Third Molar

Povezanost indeksa tjelesne mase i pojave komplikacija poslije operacijskog uklanjanja donjega trećeg kutnjaka

Introduction

The mandibular third molar is the most common impacted tooth with a prevalence between 16.7% and 68.6%, and its surgical extraction, taking into account indications and contraindications, is one of the most performed procedures in oral and maxillofacial surgery (1-3). This surgical procedure includes various surgical procedures (incision, mucoperiosteal flap elevation, targeted removal of the part of the bone that interferes with the tooth extraction, tooth extraction, flap repositioning and suturing) that can lead to the most frequently expected postoperative complications in the form of trismus, pain and swelling (4, 5).

Uvod

Treći kutnjak donje čeljusti najčešće je impaktirani zub s prevalencijom impakcije između 16,7 % i 68,6%, a njegovo je kirurško uklanjanje, uzimajući u obzir indikacije i kontraindikacije, jedan od najčešćih operacijskih zahvata oralne i maksilofacijalne kirurgije (1 – 3). Taj kirurški zahvat uklučuje različite postupke (inicizija, odizanje mukoperiostalnog režnja, strakciju, reponiranje i šivanje režnja) koji mogu rezultirati najčešćim očekivanim postoperativnim komplikacijama – otežanim otvaranjem usta (trizmus), boli i otekinom (4, 5).

Oslobađanje histamina i bradikinina zbog kirurške trau-
The release of histamine and bradykinin, due to surgical trauma, leads to vasodilatation, hyperemia and increased permeability followed by accumulation of fluid in the interstitium, and migration of monocytes and granulocytes. The above mentioned release leads to development of clinical visible swelling or edema. Histamine and bradykinin, along with the important role in development of edema, participate in development of pain by sensitizing nociceptors. Their effect is noticeable in the initial postoperative phase as a result of a very short half-life (6). Although it is an expected physiological response to the tissue damage, pain is the most common complication that significantly affects the patient's quality of life (7, 8).

Trismus is a prolonged spasm of one or more masticatory muscles resulting in the formation of connective tissue contractions. It is most often caused by improper application of nervus alveolaris inferior anesthesia, needle penetration of the pterygoideus medialis or blood vessel resulting in mild bleeding and hematoma formation. In addition, it can be caused by a mild infection or a mucoperiosteal flap elevation above the external oblique ridge. The condition is characterized by difficulty in opening of the mouth and the diagnosis is made, clinically, by measuring the maximum interincisal distance (MID), the values of which in the case of trismus are less than 35 to 40 mm. (9-11).

There exist a large number of preoperative and postoperative factors that can influence postoperative complications such as age, gender, systemic diseases, oral hygiene level, cigarette smoking, surgeon’s experience, duration of the surgical extraction, tooth angulation, depth of impaction, amount of removed bone, tooth separation, the shape and size of the mucoperiosteal flap, suturing techniques and BMI which is considered an inert site of energy storage for a long period of time, current research has shown that it actively participates in the regulation of physiological and pathological processes and is associated with immune and inflammatory changes. Moreover, there is a characteristically elevated number of inflammatory cyto-

me potiče vazodilataciju, hiperemiju i povećanu propusnost praćenu nakupljanjem tekućine u intersticiju i migracijom monocita i granulocita. To vodi prema pojavi klinički vidljive otekline ili edema. Osim važne zadaće u nastanku edema, histamin i bradikinin sudjeluju u pojavi boli podraživanjem nociceptora. Njihov učinak je primijetan u početnoj postope
rativnoj fazi zbog kratkoga poluživota (6). Iako je bol očekivani fiziološki odgovor na oštećenje tkiva, ujedno je i najčešća komplikacija u kliničkoj praksi te znatno utječe na kvalitetu postoperativnoga oporavka pacijenta (7, 8).

Ograničeno otvaranje usta ili trizmus produljeni je grč jednoga ili više žvačnih mišića koji rezultira stvaranjem kon
traktura vezivnoga tkiva. Najčešće je prouzročen nepravilnim apliciranjem anestezije u n. alveolaris inferior, točnije probe
jem igle u m. pterygoideus medialis ili krvnu žilu, što rezultira blagim krvarenjem i stvaranjem hematomata. Uz spomenuto, može biti izazvan i blagom infekcijom ili podizanjem mu
koperiostalnoga režnja iznad linea oblique externa. Stanje ka
karakterizira otežano otvaranje usta. Dijagnoza se postavlja klinički mjerenjem maksimalne interincisalne udaljenosti (engl. maximum interincisal distance – MID) čije su vrijednosti u slučaju trizmusa manje od 35 do 45 milimetara (9 – 11).

Utjecaj na postoperativne komplikacije mogu imati mno
gobrojni preoperativni i postoperativni čimbenici poput do
bi, spola, sistemskih bolesti, razine oralne higijene, pušenja, iskustva kirurga, trajanja operacije, angulacije zuba, dubin
e impakcije zuba, količine uklonjene kosti, separacije zuba, oblika i veličine mukoperiostalnoga režnja, tehnički šivanja i BMI-ja koji je tema ovoga kliničkoga istraživanja. (12 – 14). Pretolost je odavno prestala biti samo estetski problem. Kao jedan od navedenih čimbenika koji utječu na pojave postope
rativnih komplikacija, pacijenti s prekomjernom tjelesnom težinom izazov su oralnome kirurgu pri uklanjanju done

ga trećega kutnjaka zbog potencijalnih kliničkih postoperativa
vnih komplikacija u oporavku pacijenata, obnovi vitalnih funkcija i odluka o oralno-kirurškim zahvatima u budućno
sti (15, 16).

Indeks tjelesne mase (engl. body mass indeks – BMI), pret
hodno poznat kao Quetelet indeks, mjera je za procjenu sta
nja uhranjenosti osobe. Smatra se najtočnijim načinom odre
divanja odnosa između tjelesne težine i zdravstvenoga rizika. DEFINIRA SE KAO TJELESNA TEŽINA U KILOGRAMIMA POĐELJENA NA KVADRATNI METAR (kg/m2) (15, 17).

Prema podacima Svjetske zdravstvene organizacije (World Health Organization – WHO) iz 2008. godine, 57,7 % hrv
atske populacije imalo je prekomjerno tjelesnu težinu ili jo
e bilo pretolost. Takav negativan trend nije zahvatio samo Repu
bliku Hrvatsku, nego sve regije svijeta osim supsaharske Afri
ke i Azije (18, 19).

Kada se planira i obavljaju zahvati na pretolomine pacijentu, oralni kirurg mora uzeti u obzir mnogobrojne zdravstvene implikacije i anatomske aspekte pretolosti. Iako se bijelo man

sno tkivo (engl. white adipose tissue – WAT) dugo smatralo

interinim te mjestom skladištenja energije, novija istraživanja pokazuju da ono aktivno sudjeluje u regulaciji fizioloških i patoloških procesa te da je povezano s imunosnim i aps

promjenama. Štoviše, povišen broj uljanih citokina (TNF-α, IL-1, IL-6) upozorava na to da je povišena tjelesna težina po

kines (TNF-α, IL-1, IL-6) indicating that being overweight is associated with chronic low-grade systemic inflammation. The main source of tumor necrosis factor (TNF-α) and part of the produced IL-6 are macrophages found in white adipose tissue, and their number is associated with obesity and adipocyte size (15, 20, 21).

Due to the lack of scientific evidence on this issue and a relatively small number of studies that have yielded conflicting results, the aim of this study was to investigate whether there is a correlation between body mass index and the incidence of the most common expected postoperative complications such as trismus, pain and swelling. The null hypothesis of the study is that body mass index is not related to the development and severity of the most common postoperative complications: pain, trismus and swelling.

Material and methods

This cross sectional clinical trial, which was approved by the Committee of University Hospital Dubrava, was performed at the Department of Oral and Maxillofacial Surgery, University Hospital Dubrava, Zagreb, Croatia. The clinical trial was in full consent with the ethical principles defined in the World Medical Association’s Declaration of Helsinki and written in accordance with the Consort recommendation. Participation in the clinical trial was voluntary. Each patient was informed of the purpose and design of the study and was asked to sign a consent form.

Participants

In the period from April 2017 to February 2020, 84 patients with detailed medical and dental histories, and with impacted lower third molars were included in this clinical study. The sample size was calculated by the G Power software. With a 95% confidence interval, an 80% power, and an effect size of 80% (22), a total sample size of 80 individuals was necessary.

The inclusion criteria were healthy adults of both genders (ASA I physical status), with no allergies to any of the medications administered during this clinical research. All participants needed to be pain free and without signs of inflammation in surgical field. They were not allowed to take any pharmacological agents that could have an impact on postoperative recovery 7 days prior to the surgical procedure. Exclusion criteria were pregnancy, breastfeeding, tobacco or cigarette smokers, and drug abuse.

Before the surgical removal of mandibular third molars, for each patient it was confirmed radiographically by orthopantomograph that all lower third molars were in the same bone position and angulation. All surgically removed mandibular third molars belonged to the Parant 3 scale (the scale for predicting the difficulty of removing third molars).

Surgical procedure

All participants rinsed their oral cavities for 1 minute with 15 ml 0.2% Chlorhexidine (Miradent, Mouth Rinse paragard chx, Hager Pharma GmbH, Duisburg, Germany) prior to local anesthesia administration. The surgery was performed at the Department of Oral and Maxillofacial Surgery at the University Hospital Dubrava with 15 ml 0.2% Chlorhexidine (Miradent, Mouth Rinse paragard chx, Hager Pharma GmbH, Duisburg, Germany) prior to local anesthesia administration. The surgery was performed at the Department of Oral and Maxillofacial Surgery at the University Hospital Dubrava.

Materijali i metode

Presječno istraživanje provedeno je u Kliničkom zavodu za orala kirurgiju Klinike za kirurgiju lica, celjasti iusta Kliničke bolnice Dubrava u Zagrebu. Istraživanje je odobrilo Etičko povjerenstvo KB-a Dubrava te je bilo potpuno u skladu s etičkim načelima definiranimi u Helsinškoj deklaraciji Svjetskoga zdravstvenog udruženja (World Medical Association's Declaration) i napisano prema preporukama Consorta. Sudjelovanje u kliničkom istraživanju bilo je dobrovoljno. Odabrani ispitanici vlastoručno su potpisali informirani pristanak nakon što su bili obaviješteni o ciljevima i svrsi te o mogućim rizicima tijekom istraživanja.

Ispitanici

U razdoblju između travnja 2017. i veljače 2020. u ovu su kliničku studiju uključena 84 pacijenta s impaktiranim donjim trećim kutnjakom i svima je uzeta detaljna medicinska i stomatološka anamneza. Veličina uzorka izračunata je s pomoću G-Power softvura, uz interval pouzdanosti 95 %, 80 % snage te veličine učinka 80 % (22), a potrebna veličina uzorka bila je 80 osoba.

Kriterij za uključivanje bile su zdrave osobe oba spola (ASA I), bez poznatih alergija na lijekove primjenjive tijekom istraživanja. Svi su ispitanici morali biti bez znakova upale ili simptoma boli u operacijskom području. Upotreba farmakoloških agensa koji mogu utjecati na postoperativno razdoblje bila je zabranjena sedam dana prije zahvata.

Kriterij za isključivanje bili su trudnoća, dojenje, pušenje te korištenje opojnih sredstava. Zbog nedostatka znanstvenih dokaza kad je riječ o tome, te malobrojnih istraživanja koja su dala oprečne rezultate, cilj ovoga istraživanja jest ispraviti postoji li povezanost između BMI-ja te pojavnosti najčešćih postoperativnih komplikacija.

Operacijski zahvat

Prije operacije svi su pacijenti ispirali usnu šupljinu jednom trizmusa i otekline. Nulta hipoteza kliničkoga istraživanja glasi da indeks tjelesne mase nije povezan s razvojem i težinom najčešćih postoperativnih komplikacija – boli, trizmum i otekline.

Surgical procedure

All participants rinsed their oral cavities for 1 minute with 15 ml 0.2% Chlorhexidine (Miradent, Mouth Rinse paragard chx, Hager Pharma GmbH, Duisburg, Germany) prior to local anesthesia administration. The surgery was performed at the Department of Oral and Maxillofacial Surgery at the University Hospital Dubrava with 15 ml 0.2% Chlorhexidine (Miradent, Mouth Rinse paragard chx, Hager Pharma GmbH, Duisburg, Germany) prior to local anesthesia administration. The surgery was performed at the Department of Oral and Maxillofacial Surgery at the University Hospital Dubrava.
performed under local anaesthesia of inferior alveolar nerve block with a 1ml injection suspension containing 40mg of articainchloridum and 0.005mg of adrenaline in the form of adrenalinchloridum (Ubistesin-articaine, 3M ESPE, Neuss, Germany). All treatments were performed by the same surgical team, with the same equipment and by taking the same surgical approach.

Triangular flap design was performed with scalpel blade No: 15 (Carl Martin GmbH, 42657 Solingen, Germany). The incision was performed from the mandibular ramus the distobuccal part of the first lower molar. Elevation of a full-thickness mucoperiosteal flap was performed by Willinger periosteal elevator (Carl Martin GmbH, 42657 Solingen, Germany). To provide a better visibility of the surgical field, Stenbig lip retractor (Carl Martin GmbH, 42657 Solingen, Germany) was used. Straight handpiece (Ti-Max X-SG65L, NSK Europe GmbH Eschborn, Germany) and steel bone cutters (REF: H141104023, H267104016, H141104010, Komet Dental, Bras seller Gmb & Co, Lemgo, Germany) with maximum speed 40 000 rpm and cooling aqueous irrigation were used for bone removal and tooth separation. Depending on the situation, extracting forceps, root elevators, and luxating instruments were used. Extraction wounds were closed with 3-0 silk simple interrupted sutures which were removed 7 days after the surgical procedure. Postoperative instructions were the same for all participants. The analgesics that they were allowed to take as needed in the postoperative period were only ibuprofen tablets (Neofen Forte 400 mg, Belupo, Koprivnica, Croatia). All participants who used other analgesics, other pharmacological agents than those allowed were excluded from this clinical study. Given that there are conflicting studies on the results of using ice packs (cryotherapy), and because there was a possibility that some subjects would use ice packs and other patients would not, a cryotherapy of the surgical area was not allowed.

Postoperative control, observation and all postoperative measurements of the study were done by the surgeon who performed surgical procedures.

Assessment of BMI, swelling, pain and trismus

Depending on BMI, which was calculated by the ratio between weight and height, participants were divided into 4 groups: 1-underweight ≤ 18,5, 2-normal weight- 18,6-24,9, 3-pre-obesity 30-34,9, 4-obesity->30.

A four grade descriptive scale was used to measure the degree of swelling on the first, second and third postoperative day after the removal of the mandibular third molar: 0-none (no swelling), 1-light (intraoral, localized to the surgical field), 2-moderate (extraoral swelling localized to the surgical field), and 3-severe (extraoral swelling extending beyond the surgical field) (23).

A pain assessment was performed by patients who were marking the pain level on the VAS scale (10-cm long line with marked “no pain” on the far-left side of the scale (0 cm) and “unbearable pain” on the far-right side of the scale (10 cm)), 2, 4, 6, 12, 24, 48 and 72 hours after the removal of the mandibular third molar.

mandibularna anestezija – blok donjega alveolarnoga živca s 1 ml injekcijske suspensijs koja sadržava 40 mg artikainklorida i 0,005 mg adrenalina u obliku adrenaliniklorida (Ubistesin-articaine, 3M ESPE, Neuss, Njemačka).

Sve zahvate obavio je isti kirurški tim s istom opremom i kirurškim pristupom.

Zahvat je počeo sukullarnom incizijom skalpelom broj 15 (Carl Martin GmbH, 42657 Solingen, Njemačka) od početnoga dijela uzlaznoga kraka donje čelujstij do distalne plohe drugoga donjega molara. Formirani režanj odignut je u punoj debljini elevatorom prema Willingeru (Carl Martin GmbH, 42657 Solingen, Njemačka). Veća preglednost i pristupičnost operacijskome polju osigurana je razmicanjem tkiva retractorom prema Stendbergu (Carl Martin GmbH, 42657 Solingen, Njemačka).

Za osteotomiju i presjecanje zuba korišteni su kirurški nasadnik (Ti-Max X-SG65L, NSK Europe GmbH Eschborn, Njemačka) i čelična svrđla (REF: H141104023, H267104016, H141104010, Komet Dental,Brasseler Gmb & Co, Lemgo, Njemačka) s maksimalnom brzinom 40 000 o/min uz obvezno vodeno hlađenje. Za ekstrakciju zuba korišteni su različiti instrumenti (klijaška, luksoati te apektinski elevatori), a birani su ovisno o kirurškoj situaciji. Režanj je repozicioniran i pričvršćen u početnom položaju s pomoću jednostavnih pojedinačnih šavova od svile 3 – 0 (Johnson i Johnson Medical Ltd Simpson Parkway, Krikton Campus, Livingston, Engleska). Šavovi su uklonjeni sedmi dan postoperativno. Postoperativne upute bile su jednake za sve sudionike. Analgetike koje su smjeli uzimati prema potrebi bile su tablete ibuprofena (Neofen Forte 400 mg, Belupo, Koprivnica, Hrvatska). Svi oni koji su se koristili drugim analgeticima ili drugim farmakološkim sredstvima od onih dopuštenih, isključeni su iz ove kliničke studije. S obzirom na to da postoje oprečne studije o krioterapiji (korištenje hladnih obloga) te mogućnost da se neki sudionici koriste bololika, a drugi ne, njihova upotreba tijekom ovog istraživanja nije bila dopuštena.

Postoperativne kontrole, promatranja i sva postoperativna mjerenja obavio je kirurg koji je i operirao pacijente.

Procjena BMI-ja, boli, otekline i trizmusa

Ispitanici su podijeljeni u četiri različite kategorije s obzirom na izračunati BMI: 1 – pothranjenost (< 18,5); 2 – normalna tjelesna težina (18,5 – 24,9), 3 – prekomjerna tjelesna težina (25,0 – 29,9) te 4 – pretilost (> 30,0).

Mjerenje stupnja otekline provodilo se opisnom ljestvicom prvoga, drugoga i trećega postoperativnog dana: 0 – nema oteklina, 1 – oteklina u usnoj šupljini i izvan operacijskog polja, 2 – oteklina u usnoj šupljini i izvan operacijskog polja, 3 – oteklina u usnoj šupljini i izvan operacijskog polja (23).

Razina boli mjerenja je s pomoću VAS ljestvice i to 2, 4, 6, 12, 24, 48 i 72 sati poslije zahvata. Ljestvica je oblikovana kao linija duga 10 centimetara na kojoj je krajnje lijevo (0 cm) naznaka „bez boli“, a krajnje desno (10 cm) naznaka „neizdrživa bol“. Ograničeno otvaranje usta ili trizmus izmjereno je u daljenošću između incizalnih površina mandibularnoga i mak-
Trismus was measured by the distance between the incisal surfaces of the mandibular and maxillar central incisor using TheraBite scale (Atos Medical UK, Nottingham, England) before the operative procedure on the first, second and third postoperative day (24).

Statistical analysis
The SPSS software (Version 25.0. Armonk, NY: IBM Corp. Armonk, NY, USA) was used for statistical analysis. Data was tested by one-way analysis of variance (Welch’s ANOVA). The assessment of data normality was conducted by the Kolmogorov-Smirnov test. The differences were tested intragroup using the Games-Howell test. The level of significance was set at 0.05.

Results
Eighty-four patients met the criteria and participated in the present study. Sociodemographic characteristics of participants are present in Table 1. Participants were divided into 4 groups according to the calculated body mass index. The group of underweight (BMI ≤ 18.5) consisted of seven, the group of normal body weight (BMI 18.6 – 24.9) forty eight, the group of overweight (BMI 25.0 – 29.9) twenty four, and the group of obese (BMI ≥ 30.0) five respondents.

The level of postoperative pain measured by the VAS scale and the statistical differences between BMI groups are shown in Table 2. The results showed that there was a statistically significant difference in the level of postoperative pain within the first 24 postoperative hours: 4 hours (p = 0.014), 6 hours (p = 0.034, p = 0.049), 12 hours (p = 0.00, P = 0.023), and 24 hours (p = 0.010) after the surgery.

The results of the level of postoperative swelling and the ability of mouth opening between BMI groups are shown in Table 3. According to Games-Howell post hoc test, there was

Table 1. Sociodemographic characteristics of the participants
| BMI     | Age (years) | Male | Female |
|---------|-------------|------|--------|
| ≤ 18.5  | 24.71±3.65  | 4    | 3      |
| 18.6 – 24.9 | 23.56±3.09 | 25   | 23     |
| 25.0 – 29.9 | 24.63±3.39 | 14   | 10     |
| ≥ 30.0  | 27.80±2.64  | 2    | 3      |

TOTAL: N=84

Table 2. Pain level (VAS scale) between BMI groups
| PAIN (VAS scale) | BMI GROUPS                |
|-----------------|---------------------------|
|                 | ≤ 18.5 | 18.6 – 24.9 | 25.0 – 29.9 | ≥ 30.0 |
| 2 h             | 2.43 ± 1.81 | 2.34 ± 1.91 | 3.58 ± 2.92 | 3.80 ± 2.68 |
| 4 h             | 3.57 ± 1.99 | 3.71 ± 2.2e | 5.29 ± 1.9e | 5.4 ± 3.36  |
| 6 h             | 2.86 ± 1.77b | 3.56 ± 2.13c | 4.75 ± 2.13 | 5.8 ± 1.30b |
| 12h             | 2.14 ± 1.07a | 3.45 ± 2.26c | 4.17 ± 2.33b | 4.6 ± 1.67  |
| 24 h            | 2.43 ± 1.27a | 3.58 ± 2.48b | 4.92 ± 2.54c | 4.00 ± 1.87 |
| 48 h            | 3.00 ± 1.91 | 3.49 ± 2.36 | 4.21 ± 2.80 | 3.6 ± 0.55  |
| 72 h            | 2.57 ± 1.51 | 3.05 ± 2.42 | 3.9 ± 2.68  | 3.2 ± 0.45  |

a = 0.014; b = 0.034; c = 0.049; d = 0.000; e = 0.023; f = 0.010
no statistical difference for the level of postoperative swelling in all tested times. Also, the test showed there was no statistical difference for the mouth opening among the BMI groups with the exception of the first postoperative day when statistically significant differences between underweight and normal weight groups \( (p=0.026) \), also underweight and overweight groups \( (p=0.014) \) were found.

In addition to the above mentioned observations, a statistically significant difference was also found for the consumption of analgesics during the first postoperative day between normal weight and overweight groups \( (p=0.026) \).

### Discussion

The purpose of this study is to evaluate the correlation between body mass index and the occurrence of the most common postoperative complications after surgical removal of the lower third molar: trismus, pain and swelling. To the best of our knowledge, the literature on this specific topic is very scarce and there are only a few papers about this correlation. Also, this is the first clinical trial which studies this correlation in patients who were statistically approximately of equal ages, had identical tooth position, degree of bone impaction and the same Parant class in the surgical removal of the lower third molars.

Previous research has shown that obesity significantly affects health and the occurrence of operative and postoperative complications (25). However, the association between BMI and operational outcomes is still considered controversial. According to the available literature, the association between BMI and postoperative complications has shown to be statistically significant (26). The results of the present study support these findings, as there were significant differences in several outcome measures between BMI groups.

### Rasprava

Svrha ovog istraživanja bila je procijeniti povezanost indeksa tjelesne mase i pojave najčešćih postoperativnih komplikacija poslije uklanjanja donjega trećeg molara, poput trizmusa, boli i otekline. Prema našim spoznajama, dostupna literatura o ovoj specifičnoj temi poprilično je oskudna te postoji samo nekoliko radova koji se bave spomenutom povezanosti.

Osim navedenih zapažanja, statistički značajna razlika prikazana je i za konzumaciju prvoga analgetika tijekom prvoga postoperativnoga dana između skupina normalne tjelesne težine \( (p = 0.026) \) te onih prekomjerne tjelesne težine \( (p = 0.014) \).

### Table 3.

| BMI GROUPS | \( \leq 18.5 \) | 18.6 – 24.9 | 25.0 – 29.9 | \( \geq 30.0 \) |
|------------|----------------|-------------|-------------|---------------|
| Duration of operation (min.) | 23.0 ± 9.04 | 19.79 ± 6.30 | 20.17 ± 5.80 | 23.60 ± 8.96 |
| Pain Caused by Anesthetic Application (VAS scale) | 2.71 ± 0.95 | 2.62 ± 1.68 | 4.04 ± 2.65 | 4.20 ± 1.92 |
| Personal Experience of the Operation | 6.14 ± 3.76 | 7.63 ± 2.40 | 8.21 ± 1.35 | 6.60 ± 1.52 |
| Duration of Anesthesia (min) | 299.14 ± 140.98 | 264.29 ± 55.36 | 263.50 ± 53.21 | 233.00 ± 49.95 |
| Swelling | | | | |
| 1st day | 2.71 ± 0.49 | 2.77 ± 0.81 | 2.75 ± 0.53 | 2.40 ± 0.89 |
| 2nd day | 2.86 ± 0.69 | 2.88 ± 0.76 | 2.79 ± 0.83 | 3.00 ± 1.00 |
| 3rd day | 2.71 ± 0.49 | 2.73 ± 0.92 | 2.71 ± 0.96 | 3.2 ± 0.84 |
| Trismus | | | | |
| 1st day | 29.86 ± 5.01 \( a \) | 37.60 ± 10.07 \( a \) | 38.96 ± 9.23 \( a \) | 40.8 ± 14.22 |
| 2nd day | 31.00 ± 4.58 | 36.08 ± 9.52 | 36.38 ± 8.01 | 28.00 ± 11.51 |
| 3rd day | 33.00 ± 6.40 | 38.13 ± 11.11 | 35.83 ± 12.00 | 34.00 ± 6.52 |
| First analgetic (min. postoperative) | 271.00 ± 98.46 | 374.4 ± 457.07 | 213.00 ± 84.56 | 157.60 ± 53.99 |
| Analgetic consumption | | | | |
| 1st day | 2.14 ± 0.69 | 2.13 ± 1.32 | 2.17 ± 0.96 | 2.20 ± 0.45 |
| 2nd day | 1.86 ± 1.07 | 2.08 ± 1.86 | 1.96 ± 1.65 | 2.4 ± 0.55 |
| 3rd day | 1.14 ± 1.07 | 1.6 ± 1.74 \( c \) | 1.63 ± 1.56 | 1.6 ± 0.89 \( c \) |

\( a = 0.026; b = 0.014; c = 0.026 \)
tween the body mass index and the occurrence of complications varies considerably among different, and even in the same, surgical procedures (26). For instance, by reviewing the neurosurgical literature, it has been proven that there is an increased incidence, and prevalence, of postoperative complications such as infections in overweight patients undergoing spinal surgery due to degenerative diseases. On the other hand, obesity poses very little or no risk of adverse events in the field of general neurosurgery (27–29).

Although the incidence of complications following the surgical removal of the lower third molar is low and is mostly referred to minor complications, the approach to an obese person may pose particularly difficult challenges to the oral and maxillofacial surgeon (16, 30).

As previously mentioned, pain is the most common complication that the health workers encounter in oral surgery practice. According to the available literature, previous studies have not shown an association between BMI and postoperative pain levels, but neither BMI and trismus or swelling.

Moreover, Waisath et al. have studied the occurrence of postoperative infection, nerve damage, dry socket, oral antral (O/A) fistula, soft-tissue defect, temporomandibular joint dysfunction (TMD), during various dentoalveolar surgeries and obtained equal results, and found no associations between BMI and complications (31). Also, Matijević et al. stated that BMI has no effect on the duration and intensity of pain in the first seven postoperative days (25). Although in the present study the patients were not monitored for seven postoperative days, but for three (72 hours), conflicting results were obtained when compared to the aforementioned studies. The results showed that there was a statistically significant difference in the level of postoperative pain within the first 24 postoperative hours. Lower levels of postoperative pain intensity were observed in patients with the lowest BMI. After 4 hours, a significantly lower level of pain was observed in patients of normal body weight than the group of overweight patients (BMI 25.0 – 29.9) (p = 0.014). Furthermore, after 6 hours, a lower pain level was observed in underweight patients compared to normal-weight patients (p = 0.034) and in normal weight patients compared with obese patients (p = 0.049). After 12 hours, a higher pain level was observed in the overweight patients compared to those underweight (p ≤ 0.001) and normal weight (p = 0.023). Also, 24 hours after the surgery, the pain level was lower in underweight patients compared to overweight patients (p = 0.010) (Table 2.). It should be emphasized that a statistically significant difference has always been in favour of the group of overweight and obese patients. Unlike the previously mentioned studies, the advantage of this present study and the reliability of the results is that the surgery was performed by one surgical team, and each removed mandibular molar belonged to Parant scale 3. Therefore, the surgeon’s experience, the position of the tooth and the approach to surgical procedure could not interfere with the results of this clinical study.

As in previous clinical studies to date, this trial has found no association between BMI and swelling (Table 3). The authors believe that this issue should be further investigated using more objective methods. For example, swelling can be evaluated more objectively. For example, swelling can be evaluated more objectively. For example, swelling can be evaluated more objectively. For example, swelling can be evaluated more objectively. For example, swelling can be evaluated more objectively.
ated by measuring reference points on the subject’s face. Contrary to the reviewed literature, this study showed that there was a statistically significant difference in the ability of mouth opening on the first postoperative day between the group of underweight and the group of normal weight ($p = 0.026$) and underweight and overweight patients ($p = 0.014$). The difference was in favor of the normal weight group which had 7,747 and overweight group which had 9,101 higher score.

The concept of extended procedure duration due to slightly different anatomical characteristics of overweight people is frequently mentioned in the literature. More precisely, such individuals very often have more pronounced and fuller cheeks, and thus the visibility of the operative field is reduced, which makes the procedure more difficult, prolonged and more challenging (16, 22, 32). Gbotolorun et al. stated that the duration of the procedure was statistically significantly prolonged by an increase in BMI (33). Similar results can also be found in the literature of other surgical fields. For example, Ri M et al. concluded that during cardiovascular and gastroenterological surgical procedures, the increase in BMI is associated with prolonged time of the procedure (26). Contrary to these findings and the same as the study by Obimakinde et al. (32), in this clinical trial, a statistically significant correlation between a patient’s BMI and duration of surgical procedure was not found.

Akadiri et al. have mentioned that body weight and the body surface area are the factors that can make it difficult for a surgeon to perform the surgical removal of the lower third molar. However, they have emphasized that although BMI is a total body weight, it does not necessarily reflect the size of oral tissue, which could explain why there are such contradictory results on duration of surgical procedure due to BMI. (34)

There are several limitations to the study that need to be considered. There is a small number of respondents in the group of underweight and obese patients, which can be justified by the fact that such groups generally include young and physically active individuals. Furthermore, BMI is a good indicator of a patient’s nutritional status, but not ideal. Increased BMI does not necessarily mean an increased amount of adipose tissue in the body. Namely, an increased BMI can be seen in people with large muscle mass, e.g. athletes. Besides, BMI doesn’t give information about a person’s body constitution. For example, as we mentioned before, an increased BMI does not necessarily mean having a fuller cheek. Therefore, additional measurements such as waist-to-hip ratio, waist circumference, skinfold thickness and neck circumference should be used in further studies to make the results as accurate and reliable as possible (35).

Conclusions

The null hypothesis of the study was rejected. The study showed that body weight above normal had an effect on pain levels within the first 24 hours of the procedure. On the first postoperative day, difficulty in opening the mouth is visible in normal and overweight patients compared with those malnourished.

Zaključak

Nulta hipoteza istraživanja je odbačena. Naime, pokazalo se da je tjelesna masa iznad normalnih vrijednosti povezana s razinom bol i prva 24 sata postoperativnog razdoblja. Također su prvoga dana postoperativno vidljive poteškoće u otvaranju usta kod pacijenata normalne i prekomjerne tjelesne težine u usporedbi s pothranjenima.
In conclusion, pathophysiological changes that occur with weight gain reduce the quality of the postoperative period, make recovery more difficult for the patient, thus making the procedure far more complex for the oral surgeon to perform. All things considered, the authors of the present study believe that good planning and a more careful performance are needed, particularly if we take into account the growing increase in the number of obese people in the world.

Conflict of interest

The authors report no conflict of interest and the article is not funded or supported by any research grant.

Authors’ Contributions: D. J., M. C. - the main researchers contributed to the conception and design of the study, and drafted manuscript; A. T. - contributed to the analysis of the results and critically revised the manuscript; L. G. - contributed to the interpretation of the results and drafted the manuscript; K. J. - contributed to acquisition and critically revised manuscript; D. M. - contributed to the conception of the study and critically revised the manuscript. All authors gave the final approval and agree to be accountable for all aspects of work ensuring integrity and accuracy.

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Zaključno, patofiziološke promjene koje se pojavljuju s povećanjem tjelesne težine smanjuju kvalitetu postoperativnog razdoblja i otežavaju oporavak pacijenta, a oralnome kirurgu otežavaju obavljanje operacije. S obzirom na sve to smatra se da je potrebno temeljito planiranje i rad, posebice ako se uzme u obzir porast broja pretlih u svijetu.

Sukob interesa

Autori nisu bili u sukobu interesa.

Doprinos autora: D. J., M. C. – glavni istraživači, pridonijeli osmišljavanju i oblikovanju studije te pisanju teksta; A. T. – pridonio analizi rezultata i kritički revidirao rukopis; L. G. – pridonio tumačenju rezultata i pisanju teksta; K. J. – pridonio nabavi i kritički revidirao tekst; D. M. – pridonio osmišljavanju studije i kritički revidirao rukopis. Svi autori dali su konačno odobrenje i slažu se da će biti odgovorni za sve aspekte rada, osiguravajući integritet i točnost.

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MeSH pojmovi: vodenje zuba; umnjak; posljepoetivne komplikacije

Autorske ključne riječi: BMI; kiruroško uklanjanje donjega trećeg kutnjaka; al- veotomija; oteklina; bol; trizmus

Sažetak

Cilj: Oteklina, bol i trizmus najčešće su, ali i očekivane, komplikacije nakon operacijskoga uklanja nja donjega trećeg kutnjaka. Cilj ovog istraživanja bio je procijeniti povezanost spomenutih postope tivnih komplikacija i BMI nakon kirurškoga uklanjanja donjih trećih kutnjaka. Materijali i metode: U ovo istraživanja bila su uključene 84 ispitanika kojima je bilo potrebno kirurški ukloniti donja treće kutnjake. Bili su podijeljeni u četiri skupine, ovisno o izračunatom BMI-ju. Za ispitivanje dobivenih rezultata korištena je jednosmjerna analiza varijance (Welchova ANOVA), a razlike između grupa te stiranje su Games-Howellovim testom. Rezultati: Učinak BMI-ja na bol dokazan je statistički značaj- nom razlikom unutar prva 24 postoperativna sata: 4 sata (p = 0,014), 6 sati (p = 0,034, p = 0,049), 12 sati (p = 0,00, p = 0,023) i 24 sata (p = 0,010). S druge strane, nije pronadena statistički značajna povezanost za oteklinu i trizmus, s iznimkom otežanoga otvaranja usta prvoga postoperativnoga da na kod skupine pothranjenih u usporedbi s ispitanicima s normalnom tjelesnom masom (p = 0,026) i prekomjernom tjelesnom masom (p = 0,014). Zaključak: BMI utječe na pacijentov rani postoperativni oporavak.
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