Original scientific paper

Does Body Mass Index and Position of Impacted Lower Third Molar Affect the Postoperative Pain Intensity?

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A B S T R A C T

The main objective of this study was to determine to which extent body mass index and position of impacted lower third molar was affecting the pain intensity in the first seven postoperative days. The study was conducted following the extraction of the lower third molar in 108 patients. Depending on the type of information given to each particular patient, the patients were divided in two groups: the test group where patients were given detailed standard written and verbal instructions and the control group which received only standard written instructions about treatment after surgery. Using canonical discriminant analysis we investigated the influence of body mass index and the position of impacted lower third molar on postoperative pain intensity in two groups of patients. Results of this study showed that the body mass index or the tooth position did not have influence on intensity of postoperative pain. The body mass index and the position of impacted lower third molar do not affect the postoperative pain intensity.

***Key words**: postoperative pain, lower third molar, body mass index, position of teeth, canonical discriminant analysis*

Introduction

Extraction of impacted lower third molars is a common procedure in oral and maxillofacial surgery and most people require this surgery at some point in their lives[1,2]. The reasons for extracting these teeth include acute or chronic pericoronitis, presence of cysts, periodontal problems and presence of a carious lesion on the second or third lower molar[1]. In some cases, extraction is performed in preparation for orthodontic treatment or orthognathic surgery. In North America, extraction of impacted lower third molars is often intended to prevent future complications[3].

Pain after surgical measures is a subjective reaction that is influenced by several factors, including individual pain threshold, psychological assessment, general health and pain perception[4,5]. Before any such procedure, the patient must be informed of the reason for the surgery and the associated risks. Also, after surgical removal of lower third molar, the patient should be provided with postoperative instructions which should facilitate the postoperative period that is often accompanied by symptoms that significantly impair patients' quality of life.

Factors which increase the risk of postoperative discomfort is traumatic extraction[6–8], preoperative infection[8,9], cigarette smoking[9], gender[10], the place of extraction[11], use of oral contraceptives[12], the use of local anaesthetic with a vasoconstrictor[13], inadequate postoperative

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irrigation[14] and inexperienced surgeon[6,15]. Several complications are associated with extraction of impacted lower third molars, the most common being alveolitis, infection and paresthesia of the inferior alveolar nerve[16–18]. Hemorrhage during or after surgery and paresthesia of the lingual nerve are relatively rare[16,19,20], surgical technique seems to play a major role in the occurrence of the latter problem[21]. Citations indicate that many clinicians ranked pain as a significant postoperative complication[22–24].

The aim of the present study is to determine does body mass index and position of teeth have affect on the level of postoperative pain intensity after impacted lower third molar surgery during the period of seven postoperative days.

Patients and Methods

Patients

This research included patients whose lower third molar had to be removed at the Department of Maxillofacial Surgery, University Hospital Center in Osijek, Croatia. Patients who agreed to participate in the study signed an informed consent. The identity of patients was protected in such a way that their identification number was used instead of their full names. The conducted study involved 108 adults who were randomly divided in two groups, test and control group. The test group received detailed verbal and standard written instructions for the treatment after surgery, while patients in the control group received only detailed standard written instructions. The surgical procedure in all the patients was the same regardless of the surgeon's experience and was implemented through the elevation of mucoperiostal flap with or without of bone removal.

Measures

After signing the informed consent for participation in the study, we recorded basic information about each individual patient. We also recorded the position of diseased tooth. We also measured the patients' weight and height in order to calculate their body mass index. Body mass index was calculated according to the formula of the World Health Organization. After the surgery, all subjects received a visual analogue scale in order to assess the level of postoperative pain intensity during the period of seven postoperative days. The severity of pain was recorded for each day in a specially prepared table with instructions for determining the severity of pain. All patients were recommended to take paracetamol (3x500 mg) as the sole analgesic in the postoperative period.

Statistical analysis

The collected data were stored in the Microsoft Excel 2010's database, and processed by a computer using the statistical software Statistic, version 10. Using canonical discriminant analysis, we investigated the influence of the tooth position on the intensity of postoperative pain in two groups of patients. Also, by following the same principle, we examined the impact of body mass index on the intensity of pain. Canonical discriminant analysis is a combination of the techniques of principal components analysis and canonical correlation[25]. Canonical variables are linear combinations of quantitative variables from the dataset that has on one side a categorical dependent variable, and several other independent quantitative variables on the other. New variable is defined by a linear combination of the first canonical variable. It maximizes the distance center group that separates groups. The more the groups are discriminated, the less their individuals would overlap. The second canonical correlation is determined by finding the linear combination which is uncorrelated with the first canonical variable. The process of extracting canonical variables can be repeated until their number becomes equal to the number of groups minus 1 or to the number of original variables. Each canonical correlation tested the hypothesis that this particular canonical correlation and all smaller canonical correlations in the population amount to zero. The testing was carried out through the likehood ratio which is equal to Wilks lambda in respect of all canonical correlations. The obtained results of the canonical discriminant analysis are presented both in tables and graphically.

Results

Socioeconomic indicators of patients

The study included a total of 108 patients, of which 60.19% females and 39.81% males. The mean age of patients was 32 years, 33 in the test and 31 in control group. Table 1 presents a detailed account of the education level and employment of patients who were included in this study. Most patients (81.48%) completed high school, and they were equally represented both in the test- and control group. The control group included 51.85% of the patients with a high school degree while in the test group included was a slightly higher number (64.81%). Completed college and also university degree had a total of 14.82% of the patients, 16.67% in the test and 12.96% in the control group. The smallest percentage (3.70%) involved patients who completed elementary school but were still attending high school. A total of 23.15% involved university students.

Impact of body mass index on the level of postoperative pain intensity

According to the World Health Organization classification, the body mass index included the following categories: malnourished (M), normal weight (NW), overweight (OW) and the obese (O) category, which includes subcategories: obese class I (OC-I), obese class II (OC-II), and obese class III (OC-III). In our research there were no malnourished patients and no patients classified under the subcategory obese class II and obese class III. Figure 1 shows the composition of the test and control group with respect to the body weight and height as determined

TABLE 1
SOCIOECONOMIC INDICATORS OF PATIENTS

	Test group	Control group	Total
Age/years (M±SD)	33±11	31±12	32±11
Female	27 (50.00%)	38 (70.37%)	65 (60.19%)
Male	27 (50.00%)	16 (29.63%)	43 (39.81%)
Completed elementary school	1 (1.85%)	3 (5.56%)	4 (3.70%)
Completed high school	44 (81.48%)	44 (81.48%)	88 (81.48%)
Completed university	9 (16.67%)	7 (12.96%)	16 (14.82%)
High school student	1 (1.85%)	3 (5.56%)	4 (3.70%)
University student	9 (16.67%)	16 (29.63%)	25 (23.15%)
High school degree	35 (64.81%)	28 (51.85%)	63 (58.33%)
University degree	9 (16.67%)	7 (12.96%)	16 (14.82%)

M – mean, SD – standard deviation

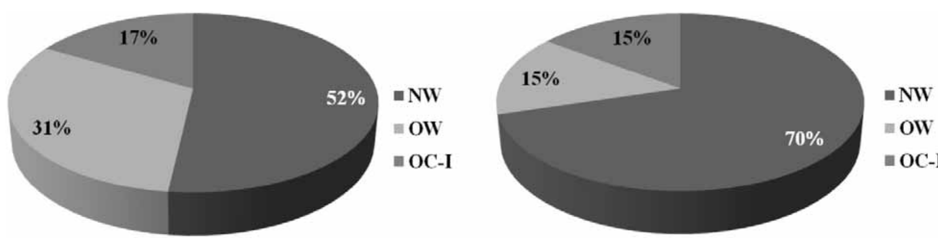

Fig. 1. The composition of the test (the left pie chart) and control (the right pie chart) group based on the body mass index. NW – normal weight, OW – overweight, OC-I – obese class I.

by the calculated body mass index. Most of the patients had normal weight, (52% in the test and 70% in the control group). Slightly fewer patients were overweight, 31% in the test and 15% in the control group, while the patients sub-classified under obese class I included 17% of the patients in the test and 15% in the control group.

The fact whether the body mass index affects the intensity and duration of postoperative pain during the seven days of postoperative period was established by canonical discriminant analysis. Canonical correlation of the patients' test group, being a measure of the correlation strength between the two variables, is shown in Table 2. Given the fact that we did not determine high value (close to 1) canonical correlations of obtained functions, we came up with a conclusion that discrimination of obtained functions was not significant.

Wilks lambda indicates the statistical significance of the discriminatory power of the model, its values ranging from 1 (no discriminatory power and no distinctive meaning) to 0 (perfect discriminatory power and perfect distinction). Wilks lambda (Table 3), which is the proportion of the total variance, is closer to the value 1 indicating poor discriminatory power of the tested functions. The χ^2-test showed the absence of significant differences between the tested functions (Table 3).

TABLE 2
EIGENVALUES AND CANONICAL CORRELATION OF THE TEST GROUP

Function	Eigen-value	Percentage of variance	Cumulative percentage of variance	Canonical correlation
1.	0.26	91.9	91.9	0.46
2.	0.02	8.1	100.0	0.15

TABLE 3
TEST OF LIKEHOOD RATIO IN THE TEST GROUP

Test function	Wilks lambda	χ^2	d_f	p
1.	0.78	12.23	14	0.59
2.	0.98	1.09	6	0.98

Wilks lambda – an indicator of statistical significance discriminatory power, χ^2 – chi square test for nonparametric tests, d_f – degrees of freedom, p – probability of error

Graphical representation of the first two canonical functions of the impact of body mass index on postoperative pain intensity in the test group is shown in Figure 2.

Canonical correlation of the control group of patients is shown in Table 4. Since no high values of canonical correlations of obtained functions were found, we concluded therefore that discrimination of obtained functions was not significant.

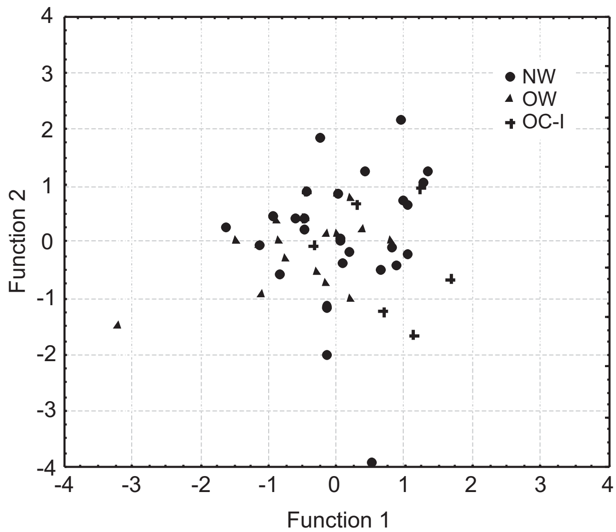

Fig. 2. Graphical representation of the canonical discriminant analysis of the impact of body mass index on postoperative pain intensity in the test group. NW – normal weight, OW – overweight, OC-I – obese class I.

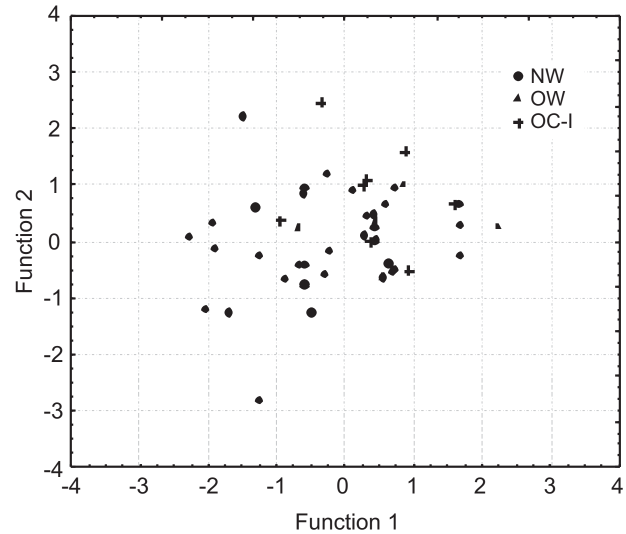

Fig. 3. Graphical representation of the canonical discriminant analysis of the impact of body mass index on postoperative pain intensity in control group. NW – normal weight, OW – overweight, OC-I – obese class I.

TABLE 4
EIGENVALUES AND CANONICAL CORRELATION OF THE CONTROL GROUP

Function	Eigen-value	Percentage of variance	Cumulative percentage of variance	Canonical correlation
1.	0.19	55.3	55.3	0.40
2.	0.15	44.7	100.0	0.36

In this case too, Wilks lambda (Table 5) is closer the value 1 which indicates a poor discriminatory power of the tested functions. The χ^2-test showed the absence of significant differences between the tested functions (Table 5).

TABLE 5
TEST OF LIKEHOOD RATIO IN THE CONTROL GROUP

Test function	Wilks lambda	χ^2	d_f	p
1.	0.73	15.10	14	0.37
2.	0.87	6.81	6	0.34

Wilks lambda – an indicator of statistical significance discriminatory power, χ^2 – chi square test for nonparametric tests, d_f – degrees of freedom, p – probability of error

Graphical representation of the first two canonical functions of the impact of body mass index on postoperative pain intensity in the control group is shown in Figure 3.

Impact of tooth position on the level of postoperative pain intensity

Figure 4 shows the content of individual type positions of impacted lower third molar in the test and in the control group. In the test group, we recorded an equal content of impacted teeth with mesioangular (38.88%) and vertical (35.19%) position. Somewhat less represented were teeth with distoangular (11.11%) and buccoangular (9.26%) position while the smallest content accounted impacted teeth which were linguoangular (5.56%) position. Also, in the control group, there were an equal proportion of impacted teeth with mesioangular (44.44%) and vertical (40.74%) position. Somewhat less was the number of teeth with distoangular (11.11%) position while the smallest content included impacted teeth with linguoangular (3.71%) position. Patients with the type of buccoangular position of impacted teeth were not registered in the control group.

By using canonical discriminant analysis, we established whether the tooth position had affect on the intensity and duration of postoperative pain during the seven days period. Canonical correlation of the test group is presented in Table 6. Since no high values of canonical correlations of obtained functions were found, we concluded therefore that discrimination of obtained functions was not significant.

Wilks lambda (Table 7) is closer to the value 1, which shows us that discriminatory power of the tested functions is poor. The χ^2-test showed the absence of significant differences between the tested functions (Table 7).

Graphical representation of the first two canonical functions of the impact of the tooth position on postoperative pain intensity in the test group is shown in Figure 5.

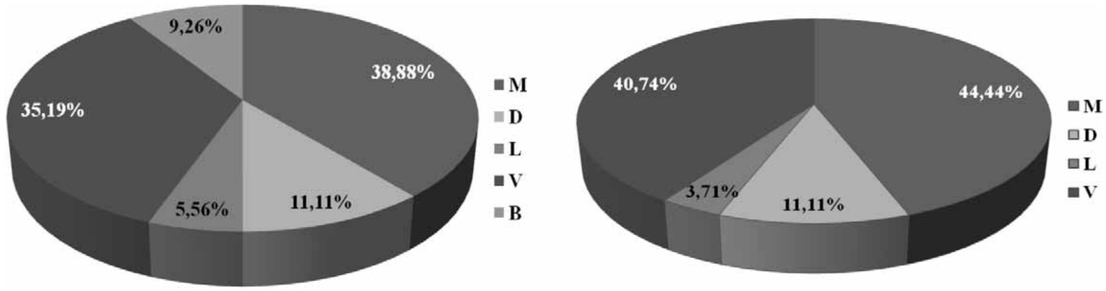

Fig. 4. Content of the type position of impacted lower third molar in the test (the left pie chart) and control (the right pie chart) group. M – mesioangular, D – distoangular, L – linguoangular, V – vertical, B – buccoangular.

TABLE 6
EIGENVALUES AND CANONICAL CORRELATION OF THE TEST GROUP

Function	Eigen-value	Percentage of variance	Cumulative percentage of variance	Canonical correlation
1.	0.35	53.2	53.2	0.51
2.	0.19	29.7	82.9	0.40
3.	0.06	9.2	92.1	0.24
4.	0.05	7.9	100.0	0.22

TABLE 7
TEST OF LIKEHOOD RATIO IN THE TEST GROUP

Test function	Wilks lambda	χ^2	d_f	p
1.	0.56	27.34	28	0.50
2.	0.75	13.37	18	0.77
3.	0.90	5.08	10	0.89
4.	0.95	2.36	4	0.67

Wilks lambda – an indicator of statistical significance discriminatory power, χ^2 – chi square test for nonparametric tests, d_f – degrees of freedom, p – probability of error

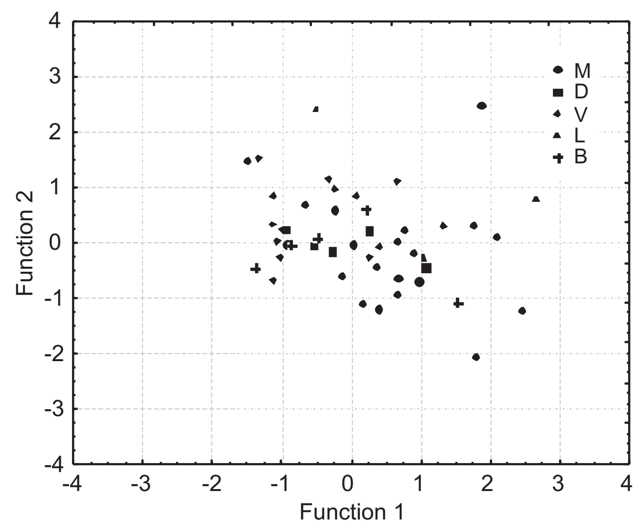

Fig. 5. Graphical representation of the canonical discriminant analysis of the impact of the tooth position on postoperative pain intensity in the test group. M – mesioangular, D – distoangular, V – vertical, L – linguoangular, B – buccoangular.

Canonical correlation of the control group is shown in Table 8. Since no high values of canonical correlations of obtained functions were found, we concluded therefore that discrimination of obtained functions was not significant.

Wilks lambda (Table 9) was closer to the value 1 for the second and the third discriminant function what indicates a poor discriminatory power of these functions, whereas the discriminatory power of the first discriminant function was of greater discriminatory power (Wilks lambda = 0.45). The χ^2-test showed the existence of significant difference ($\chi^2 = 37.58$; p = 0.01) only in the first discriminant function (Table 9), which did not result in better visual resolution (Figure 6).

Graphical representation of the first two canonical functions of the impact of the tooth position on postoper-

TABLE 8
EIGENVALUES AND CANONICAL CORRELATION OF THE CONTROL GROUP

Function	Eigen-value	Percentage of variance	Cumulative percentage of variance	Canonical correlation
1.	0.73	73.4	73.4	0.65
2.	0.18	18.5	91.9	0.39
3.	0.08	8.1	100.0	0.27

TABLE 9
TEST OF LIKEHOOD RATIO IN THE CONTROL GROUP

Test function	Wilks lambda	χ^2	d_f	p
1.	0.45	37.58	21	0.01
2.	0.78	11.64	12	0.48
3.	0.93	3.67	5	0.60

Wilks lambda – an indicator of statistical significance discriminatory power, χ^2 – chi square test for nonparametric tests, d_f – degrees of freedom, p – probability of error

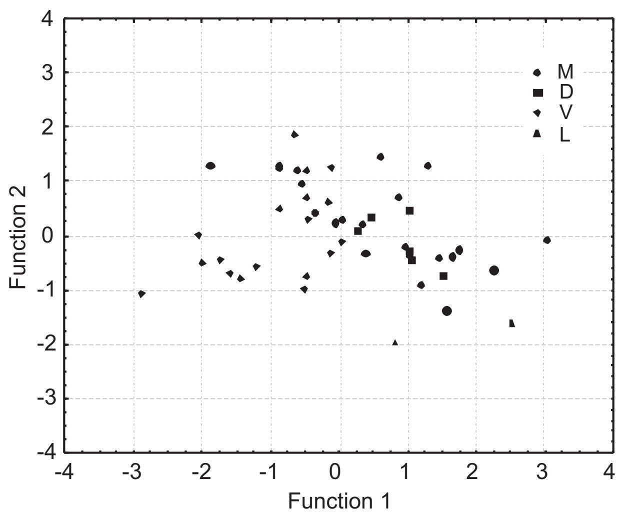

Fig. 6. Graphical representation of the canonical discriminant analysis of the impact of the tooth position on postoperative pain intensity in the control group. M – mesioangular, D – distoangular, V – vertical, L – linguoangular.

ative pain intensity in the control group is shown in Figure 6.

Discussion

In this research, we examined the impact of the body mass index and the position of extracted tooth on the level of postoperative pain intensity following the surgical removal of lower wisdom tooth in a total of 108 patients. Citations indicate that many clinicians ranked the pain as the most significant postoperative complication[22–24].

Previous research of the body mass index indicates that being overweight is a significant factor that affects the health of people, the complications during the surgical procedure and the occurrence of postoperative complications in patients[26–30]. In our study, using the canonical discriminant analysis, the influence of the body mass index on the intensity and duration of postoperative pain, which according to the literature data is regarded as one of the most significant postoperative complications[22,23]. Comparing the body mass index of our patients in the test and the control group, it is evident that the rate of obesity in both groups was comparable (about 20%), which was also reported in previous studies[31]. The strength of correlation between the body mass index and postoperative pain intensity was low, as is evident from the calculated values of canonical correlation functions obtained for both the test and control groups of patients. Low values of canonical correlations indicate that discrimination of obtained functions is not significant for any of the studied groups. Such obtained conclusion is also confirmed through derived and calculated high values of Wilks lambda representing the proportion of the total variance and they are the indicators of statistical significance of the discriminatory power of the model. From the high values of Wilks lambda we can conclude that discriminatory power of the tested functions is poor i.e. that there is no distinctive significance between the two groups of patients. In addition, the χ^2-test showed the absence of significant differences between the tested functions. Canonical discriminant analysis revealed that the body mass index does not affect the intensity and duration of pain in either study group during the seven days of postoperative period. Carvalho and Vasconcelos do Egito[31] suggest in the results of their studies that the body mass index is not a significant predictor of surgical complications following removal of impacted lower third molar which also proved to be insignificant in our case of determining the possible influence of the body mass index on the intensity and duration of postoperative pain. In the previous research reports regarding the impact of the body mass index on postoperative pain, the authors presented the results which are comparable to ours, although they emphasize in their further recommendations the importance of the potential impact of obesity on complications during the surgery alone[29,32,33].

The largest share in both groups of patients under research has taken the lower third molar of mesioangular position as it had been also observed in the previous studies[34,35]. With a further analysis of the results, we wanted to determine if the tooth position affects the intensity and duration of postoperative pain while we also conducted the canonical discriminant analysis. Calculated values of canonical correlation functions obtained indicate that there was a low correlation between the strength of the tooth position and intensity of postoperative pain. Also in this case, the calculated values indicated quite high Wilks lambda values. Low values of canonical correlations indicate that the discrimination of obtained functions is not significant, and the high values of Wilks lambda indicate that discriminatory power of the tested functions is low i.e. that there is no distinctive significance between the two groups. Here also, the χ^2-test showed the absence of significant differences between the tested functions. Canonical discriminant analysis showed that the tooth position does not affect the intensity and duration of postoperative pain in any of the studied groups. Literature points to a number of the research that examined the potential impact of lower third molar position on the intensity and duration of postoperative pain[34–38].

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UTJEČE LI INDEKS TJELESNE MASE I POZICIJA IMPAKTIRANOG DONJEG UMNJAKA NA INTENZITET POSLIJEOPERACIJSKE BOLI?

S A Ž E T A K

Glavni cilj ovoga istraživanja bio je utvrditi u kojoj mjeri indeks tjelesne mase i pozicija impaktiranog donjeg umnjaka utječu na intenzitet boli prvih sedam poslijeoperacijskih dana. Istraživanje je provedeno nakon odstranjenja donjeg umnjaka kod 108 pacijenata. Ovisno o tipu informacije dane svakom pacijentu posebice, pacijenti su podijeljeni u dvije skupine: ispitnu u kojoj su pacijenti dobili detaljan standardni pismeni i usmeni naputak te kontrolnu skupinu u kojoj su dobili samo standardni pismeni naputak o postupanju nakon operativnoga zahvata. Kanoničkom diskriminacijskom analizom istražio se utjecaj indeksa tjelesne mase i pozicije impaktiranog donjeg umnjaka na intenzitet poslijeoperacijske boli kod istraživanih skupina pacijenata. Rezultati ove studije pokazali su da na intezitet poslijeoperacijske boli nisu imali utjecaja indeks tjelesne mase kao ni pozicija zuba. Indeks tjelesne mase i pozicija impaktiranog donjeg umnjaka ne utječu na intenzitet poslijeoperacijske boli.