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SCHOLARENA

Journal of Oral Health and Dental Science

RESEARCH ARTICLE

ISSN: 2577-1485

Removal of Mandibular Third Molars by Zero-Hammering and Hammering Methods: Analysis of the Psychological Impact and Complications

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Citation: Xue L, Zeng Y, Fang C, Cheng W, Li Y (2020) Removal of Mandibular Third Molars by Zero-Hammering and Hammering Methods: Analysis of the Psychological Impact and Complications. J Oral Health Dent Sci 3: 304

Abstract

Background/purpose: Incomplete eruption of the mandibular third molar can lead to the inflammation in its crown soft tissue, food impaction or second molar caries. The ultimate way to solve these problems is the removal of mandibular third molars. In this study, we evaluated the psychological impact, extraction time and complications of two mandibular impacted lower third molar removal methods (zero-hammering and hammering methods).

Material and methods: A total of 400 cases with removal of mandibular impacted lower third molars were randomly divided into experimental (zero-hammering removal) and control (hammering removal) groups. Following the removal of the mandibular impacted lower third molars, questionnaire (including pain rating and score of State-Trait Anxiety Inventory, STAI) was immediately performed. The tooth extraction time and complications (soft tissue swelling, mouth opening restriction, dry socket symptoms and mandibular nerve damage) were recorded.

Results: The tooth extraction time was not significantly different between the two groups. Pain in the experimental group was less severe than that in the control group. STAI score and the frequency of complications in the experimental group were significantly lower than those in the control group.

Conclusions: Based on these results, we concluded that removal of mandibular impacted lower third molar by zero-hammering method does not increase the tooth extraction time, but significantly reduces the occurrence of complications and mitigates the psychological stress, which can be used as a regular surgical approach for removal of mandibular impacted lower third molar.

Keywords: Zero-Hammering Method; Hammering Method; Tooth Extraction; Psychological Stress

Introduction

In many cases, incomplete eruption of the mandibular third molar can lead to the inflammation in its crown soft tissue, food impaction or second molar caries [1,2]. The ultimate way to solve these problems is the removal of mandibular third molars [3,4]. Traditionally, mandibular third molar is removed by hammering method, which utilizes hammer and chisel to remove the bone and adjacent tooth resistance [5]. However, powerful hammering force often leads to adverse reactions, including physical (such as headache, pains in the temporomandibular joint and injuries, soft tissue swelling and nerve damage) and psychological discomforts (anxiety for future dental treatment) [6-13]. In order to alleviate physical and psychological discomfort, we eliminated the utilization of hammer and chisel. In contrast, we attempted to use impact pneumatic hand machine with 45 elevation degree and special cutting drill to remove bone and adjacent tooth resistance before the removal of the mandibular third molar. We refer it as zero-hammering tooth extraction method. In this study, we compared the pros and cons for these two methods in 400 cases with removal of the mandibular impacted lower third molar.

Clinical data

A total of 400 cases with removal of mandibular impacted third molars were selected from outpatients between January 2014 and April 2019. These cases were randomly divided into the experimental (zero-hammering) group (200 cases, 108 males and 92 females with an average age of 26.5) and the control (traditional hammering) group (200 cases, 113 males and 87 females with an average age of 27.6) [14]. According to modification of Juodzbalys and Daugela classification, all of mandibular impacted third

molars were divided into three classes: class I(simple), class II(moderate) and class III(complicated). In the study, the patients included systemically healthy individuals with impacted mandibular lower third molar. Exclusion criteria from the study were; hepatic or renal disease, infection of the surgical region, lactation or pregnancy, heart disease, mental disease, cognitive dysfunction. Informed consent was obtained from all the patients participated. The research protocol was reviewed and approved by the Ethics Committee of ChongQing medical University. The study protocol conforms to the ethical guidelines of the Declaration of Helsinki.

Tooth extraction methods

Oral panoramic radiograph was taken to examine the impacted tooth. The teeth in both groups were extracted by experienced senior dentists and an assistant. Anesthesia was performed by using 2% lidocaine through inferior alveolar nerve, lingual nerve and buccal nerve. Extraction of tooth started after anesthesia.

Tooth extraction in the experimental group

Teeth in the experimental group were extracted by the following procedures.

Flap: An incision was made in the buccal oblique ridge of the molars and cut forward to the second molar close to the buccal area. The incision was made straight to the bone surface and all layers of the periosteum were cut open. Subsequently, the incision was made forward in the gum sulcus along the papilla shape of the second molar and extended toward the first molar. The gum and the buccal mucoperiosteal flap were separated with papilla remained on the tissue flap. Cheek retractor was used to pull buccal gingival mucosa flap, exposing the buccal site of the impacted tooth and the coronal bone surgery area.

Bone removal: An impact pneumatic hand machine and special cutting drill (instruments were shown in Figure 1)for surgery were used to remove coronal bone and part of the buccal bone according to oral panoramic radiograph. During the removal of the buccal bone, the cutting drill should be in parallel to the tooth long axis and a groove was grinded between the impacted tooth and the buccal bone wall. The bottom of the groove can reach to the furcation.

Figure 1: The instruments used to remove the mandibular third molars

Tooth extraction: The portion of the tooth that needs to be cut was determined according to the resistance. Generally, the crown or neck of the teeth is grinded in buccolingual direction, but the whole tooth body is not grinded. Only the crown or 4/5 of the tooth neck need to be cut, while the remaining 1/5 on the lingual side does not need to be cut, which can not only avoid lingual nerve injury, but also increase the cut efficiency. The blade of minimally invasive dental elevator was inserted into the grinded gap and rotated gently. The tooth was fractured into two parts: far and middle parts. If the resistance of the impacted tooth is reduced, the tooth can be gradually loosen and dislocated by the minimally invasive dental elevator with buccal bone plate as a fulcrum. In the case that the tooth resistance is still high, the cut drill was used to separate the tooth and root and the middle and far part of the tooth were individually pushed out.

Wound suturing: The extraction socket was cleaned and the soft tissue flap was sutured.

Tooth extraction in the control group

Incision: Incision was performed as described in the experimental group.

Bone removal: Bone chisel and hammer were used to chisel away the top portion of the tooth and part of the bone tissue at the buccal site. Consequently, the tooth was exposed.

Tooth separation and extraction: Bone chisel and hammer were used to separate the tooth based on the resistance. Crown-hacking and /or root-splitting were used to remove the adjacent tooth and root resistance. If necessary, bone chisel was inserted into between the tooth and alveolar bone (by hammering) through the tooth surface to make the socket become bigger. Subsequently, the tooth was pushed out by a dental elevator.

Wound suturing: Suturing was performed as described for the experimental group. For those patients who do not need to remove the bone, tooth extraction starts from tooth separation. After the surgery, the patients were told to take precautions and filled out the questionnaire. Regular antibiotics(Ornidazole 500mg bid)were used for 3 days after the surgery.

Questionnaire

Questionnaire was performed immediately after tooth extraction. The questionnaire included pain score table and State-Trait Anxiety Inventory (STAI) [15]. The patients were informed of the purpose of the study and questionnaire was distributed after obtaining the consent. The requirement of filling out the questionnaire was explained and the filled questionnaire was recollected immediately. The pain is recorded with numeric analog scale (NRS) scale which showed 11 points ranged from 0 (no pain) to 10 (highest pain intensity) points [16].The scale of the pain was divided into 0 (no pain), 1 (mild pain, between 1 and 3), 2 (moderate pain, between 4 and 6) and 3 (severe pain,more than 7) [17,18]. STAI was used to evaluate the immediate or very recent experience or feelings of a particular fear, tension, anxiety and neuroticism. This scale was used for the evaluation of anxiety under the stress conditions. STAI was divided into 20 items and each item was graded into 1, 2, 3 and 4. Among these 20 items, items 1,2,5,8,10,l l,15,16,19,20 were reversely graded: higher score indicated higher degree of anxiety.

Medical examination

Three days after tooth extraction, patients were reexamined by experienced dentists.

The scale of soft tissue swelling was divided into 0 (no swelling), 1 (buccal mucosa swelling), 2 (buccal mucosa and parotid swelling in the chewing muscle area) and 3 (buccal, parotid masseter muscle area and cheek area or submandibular swelling). The scale of the mouth-opening restriction was divided into 0 (no restriction on mouth-opening: two and half fingers, approximately 2.5cm, can be placed between the edges of the upper and lower incisors), 1 (mild restriction on mouth-opening: two fingers, approximately 2-2.5cm, can be placed between the edges of the upper and lower incisors), 2 (moderate restriction on mouth-opening: one finger, approximately 1-2cm, can be placed between the edges of the upper and lower incisors), 3 (severe restriction on mouth-opening: less than one finger, <1cm, can be placed between the edges of the upper and lower incisors).

The dry socket symptom indicates the significant spontaneous pain after 2-3 days of tooth extraction. The pain can be radiated to the ear temporal or mandibular front teeth. Emptiness within the tooth socket, bone wall tenderness and odor in the extraction socket occur. The scale of the dry socket can be divided into 0 (no dry socket symptoms) and 1 (occurrence of dry socket symptoms). The scale of lower lip numbness (mandibular nerve damage) can be divided into 0 (no numbness) and 1 (occurrence of numbness).

Statistical analysis

The total score for STAI and tooth extraction time were presented as average± standard deviation (X±S). Data statistical analyses were carried out with SPSS 15.0 (SPSS, Chicago, IL). Student t test was used to compare the score between the experimental and control groups. Rank sum test was used to compare modification of Juodzbalys and Daugela classification, pain, soft tissue swelling and mouth-opening restrictions between the two groups. Chi-square test was used to compare lower lip numbness and dry socket symptoms between the two groups. $P<0.05$ was considered significantly different.

Results

There was no significant difference between the modification of Juodzbalys and Daugela classification in the experimental group and that in the control group ($P>0.05$) (see Table 1).There were no soft tissue tearing, lingual nerve impairment and mandibular fractures in both groups [19]. There was no significant difference between the tooth extraction time in the experimental group (34.1 ± 13.8min) and that in the control group (33.8 ± 11.2min) ($P>0.05$). The STAI total score in the experimental group (49.43±7.65) was significantly lower than that in the control group (58.89±8.23) ($P<0.01$). The scores for pain, soft tissue swell, mouth-opening restriction, lower lip numbness and dry socket symptoms in the experimental group were significantly improved comparing with those in the control group ($P<0.05$).(see Table 2)

	class I	class II	class III	P
Experimental group(n=200)	107	86	7	>0.05
Control group(n=200)	108	83	9	

Table 1: Modification of Juodzbalys and Daugela classification

	Experimental group (n=200)				Control group(n=200)				P
	0	1	2	3	0	1	2	3	
Pain	0	110	75	15	0	40	107	53	<0.01
Soft tissue swelling	41	112	38	9	22	58	88	32	<0.01
Mouth-opening restriction	0	113	79	8	0	44	127	29	<0.01
Dry socket symptom	192	8			179	21			<0.05
Lower lip numbness	200	0			196	4			<0.05

Table 2: Comparison of the complications between the experimental and control groups

Discussion

Removal of the mandibular wisdom tooth is one of the common dental surgeries. Due to the very limited surgery space and complex oral anatomy, traditional hammering and tooth crown splitting may result in the soft or hard tissue injuries, tooth dislocation or even falling into the submandibular space, which brings greater difficulties during tooth extraction, as well as pain, swelling, anxiety and other mental and physical side effects after tooth extraction [20-25].

With the technological advances and increased demands by the patients, the idea to minimize the trauma during the tooth extraction process has been introduced into the oral medicine. The development of impact pneumatic hand machine and special cutting drill opened a new era of tooth extraction with zero hammering. In the zero-hammering method, impact pneumatic hand machine and special cutting drill were used to remove the bone and separate the tooth, which can precisely control the amount of bones that need to be removed according to panoramic radiograph and reduce tooth extraction injuries. In this study, we used impact pneumatic hand machine and special cutting drill to replace traditional hammering and chiseling. Our results showed that zero-hammering method does not increase the surgery time comparing to the traditional hammering method.

Many people regard the tooth extraction as a psychologically painful experience. In order to study the psychological feelings during extraction surgery, we conducted an STAI survey for 400 cases with extraction of the mandibular lower impacted third tooth. The results showed that the STAI score in the experimental group was 49.43 ± 7.65, which was significantly lower than that (58.89 ± 8.23) in the control group, which indicates that zero-hammering method can reduce the psychological discomfort. Anxiety is significantly reduced without the feeling of being hammered, thereby reducing the extraction psychological trauma. Removal of impacted wisdom tooth often leads to complications, including soft tissue swelling, restrictions in mouth opening, lip numbness and dry socket symptoms. Soft tissue swelling is prone to occur after mandibular tooth extraction, and it is often due to the surgical trauma, particularly in patients with hammering [26]. Restrictions in mouth opening are often associated with postoperative fear of pain, or temporomandibular joint injury during the process of hammering [27]. Inferior alveolar nerve is closely associated with mandibular third molars. During the process of hammering or tooth elevating by the tooth elevator, the tooth root is pushed back, which may crush the thin wall of the mandibular canal and damage the nerves, resulting in lower lip numbness [28]. Dry socket symptom is acute infection and occurs mostly in 2-3 days after tooth extraction, which brings great suffering to the patient. All the complications described above are frequently associated with the removal of mandibular third molars. Our results showed that the degree of soft tissue swelling, restrictions in mouth opening, lower lip numbness and dry socket symptoms in the experimental group are significantly improved comparing to those in the control group. These results indicated that the use of zero-hammering method for the removal of mandibular lower impacted third molar greatly reduced the complications and both psychological and physical sufferings to the patients.

In conclusion, impact pneumatic hand machine and special cutting drill can replace bone hammer and chisel, thereby achieving zero hammering for tooth extraction. Use of zero-hammering extraction method for the removal of mandibular impacted lower third molar reduced periodontal tissue damage, the incidence of complications and mental stress, while the extraction time is not increased.

Compliance with Ethical Standards

Conflict of Interest:

Lingli Xue declares that he has no conflict of interest. Yan Zeng declares that he has no conflict of interest. Chuan Fang declares that he has no conflict of interest. Yadong Li declares that he has no conflict of interest.

Acknowledgement

The work was supported by the Science and Technology Research Project of Chongqing Municipal Commission of Education (Grant No.KJ130318, 14SKD07) Natural Science Foundation Project of CQ CSTC (Grant No. cstc2018jcyjAX0763) and Chongqing Municipal Health Bureau (Grant No. 2017HBRC004)

"Ethical approval: All procedures performed in studies involving human participants were in accordance with the ethical standards of ChongQing medical University and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards." Informed consent: Informed consent was obtained from all individual participants included in the study.

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