

Influence of COVID-19 Epidemic on the Decision-making Process for Impacted Mandibular Third Molar Removal

Chi Wang

wenzhou medical university school hospital

Jin Xiao

wenzhou medical university school hospital

jingyuan yang (✉ yangjy202010@163.com)

wenzhou medical university school hospital of stomatology <https://orcid.org/0000-0003-4153-6226>

Research article

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Abstract

Background

Since December 2019, an infectious disease caused by SARS-CoV-2 has swept through the world and has had a significant impact on dental services. Methods: In this study, from April 21 to April 28, 2020, a questionnaire survey was taken by a self-made questionnaire in order to investigate the impact of the COVID-19 epidemic on the decision-making process for impacted mandibular third molar removal and related clinical teaching. The Wenjuanxing software was used as a survey platform to survey oral clinicians engaged in the extraction of mandibular third molars.

Results

A total of 321 valid questionnaires were returned in this study. Because of the COVID-19 pandemic. The results showed that 22.4% of clinicians were temporarily not performing tooth extractions in outpatient clinics, and 50.2% of clinicians were temporarily not performing impacted tooth extractions. The main reason cited was that "Aerosol-generating high-speed handpieces were not recommended to be used during the pandemic." During the pandemic, the surgical handpiece with copious saline irrigation was the main method used for bone removal; the hammer-and-chisel method was considered to be too traumatic and posed too high a risk of iatrogenic injury.

Conclusion

The implementation of epidemic control measures during the novel COVID-19 pandemic significantly affects clinical decision making regarding impacted mandibular third molar extractions, the main reason cited was the contraindication to using aerosol-generating high-speed handpieces. The hammer and chisel method may represent a valuable surgical application under the requirements for epidemic prevention and control.

Background

At the end of 2019, an infectious pneumonia, COVID-19, caused by the novel coronavirus SARS-CoV2, broke out in Wuhan, China, and quickly spread throughout the world. As of October 15, 2020, COVID-19 has caused 38 million infections and 1 million deaths worldwide, and the number of infections is still rising rapidly. The main transmission routes of COVID-19 include droplet transmission, aerosol transmission [1,2], and direct contact transmission [3]. In addition, some studies suggest that oral-fecal transmission may also be a mode of transmission, this is, however, unconfirmed [4].

The delivery of oral health services routinely involves the use of three-way air–water syringes, high-speed handpieces, ultrasonic scalers, and other dental instruments which inevitably produce droplets and generate aerosols[5]. Dental treatment clinics and facilities are therefore high-risk locations for transmitting the COVID-19 infection.[6, 7] During the COVID-19 outbreak, elective oral clinical operations

were prohibited, and only carefully triaged emergency care was permitted, for debilitating conditions, and with potentially deleterious sequela[8]. There has been significant success in the prevention and control of the spread of COVID-19 in China. As a result, oral healthcare facilities are gradually being permitted to perform elective clinical dentistry. However, it is important to implement strict protocols for preventing cross-contamination and nosocomial infections. New guidelines have been published, mandating that dental hospitals implement specific measures for strengthening protective barriers and personal protective equipment.

These measures have impacted the ability of clinicians to perform certain dental treatment procedures. Therefore, we conducted this study by a questionnaire survey to investigate the impact of the COVID-19 pandemic on dentists' clinical decision-making for managing impacted mandibular third molars and analyze the potential value of the hammer-and-chisel surgical method during the pandemic. In addition, we statistically analyzed the treatment, prognosis and postoperative response, and postoperative satisfaction of patients with impacted tooth who visited the Department of Oral and Maxillofacial Surgery of the School & Hospital of Stomatology Wenzhou Medical University from March 5, 2020 to May 20, 2020.

1. Materials And Methods

1.1 Subject

From April 21 to April 28, 2020, dentists engaged in the extraction of impacted mandibular third molars were recruited in order to investigate the impact of the COVID-19 epidemic on the decision-making process for impacted mandibular third molar removal and related clinical teaching. The Wenjuanxing software was used as a survey platform to survey oral clinicians engaged in the extraction of mandibular third molars.

1.2 Sampling method

Random sampling surveys were conducted on dentists engaged in oral clinical treatment, and performing dental extractions in outpatient clinics. Patient information was obtained through a cross-sectional study.

1.3 Inclusion and exclusion criteria

Questionnaire Inclusion criteria: (1) dentists engaged in the extraction of impacted mandibular third molars; (2) age was older than 18 years old; (3) participants who have signed informed consent.

Exclusion criteria: (1) participants whose data were incomplete; (2) dropped out during the research.

Inclusion criteria: 1. Patients diagnosed with impacted tooth during the epidemic control period from 3.5 to 5.28. 2. Patients older than 18 years of age. 3. Patients who accept follow up. Exclusion criteria: 1. Patients lost or refused to be followed up. 2. Patient data were incomplete.

1.4 Investigation method

This survey used the Wenjuanxing software to design an online self-designed questionnaire for the survey. The survey included four parts: (1) The biographic information of the dentists, including gender, age, number of years worked, and education. (2) The preferred surgical method for removing bone surrounding impacted teeth and managing teeth adjacent to the impacted teeth, before the COVID-19 pandemic. (3) Attitude to the extraction of impacted mandibular third molars during the pandemic and the preferred surgical method for removing bone surrounding impacted teeth and managing teeth adjacent to the impacted teeth during the COVID-19 pandemic. (4) Cognition and learning of different methods for removing bone surrounding impacted teeth, and for managing teeth adjacent to the impacted teeth.

Patients were followed up through the electronic medical record system to select the patients who were diagnosed as impacted teeth and visited the School & Hospital of Stomatology Wenzhou Medical University from 20.3.5 to 20.5.20. Through accessing the electronic medical record, the patients who met the inclusion criteria were followed up one by one, and the patients' treatment, postoperative swelling and pain reaction and postoperative satisfaction were counted.

1.5 Statistic analysis

We used the software program SPSS 17.0 (IBM, Chicago, USA) to conduct the statistical analysis. The continuous variables of normal distribution were expressed as mean \pm standard deviation, the continuous variables of non-normal distribution were expressed as median (interquartile range), the categorical variables were expressed as frequency (percentage[%]). The counting data were tested by chi-square test. A value of $P < 0.05$ was considered statistically significant.

2. Results

2.1 Questionnaire collection results

The questionnaire was distributed via the Wenjuanxing online platform on April 21, 2020. A week later, a total of 350 questionnaires were retrieved, of which 321 were valid questionnaires, with an effective rate of 91.7%. The main reason for exclusion was that the respondents were not engaged in the extraction of impacted teeth.

2.2 The baseline characteristic

Among the 321 effective respondents, 171 were male, accounting for 53.3%, and 150 were female, accounting for 46.7%. Among the groups, the 31–40 years age group accounted for the highest proportion, 61.7%, followed by the 20–30 years age group, accounting for 19.6%. Correspondingly, the number of people with a working period of 6–10 years is the largest, 120, accounting for about 37.4%, followed by the 11–20 years age group and the 0–5 years age group, accounting for 28.0% and 25.2%, respectively. In the academic distribution, the proportion of oral and maxillofacial surgeons with a master's degree is the highest at 45.8%, followed by general dentists at 35.5%. The proportion of dentists

in private dental clinics is comparable to that of those in general hospitals, 40.2% and 37.4% respectively, and the rest are oral and maxillofacial surgeons in specialized hospitals. The details were listed in the Table 1.

2.3 Respondent's previous impacted tooth extraction

In daily work before the epidemic, 249 of the 321 respondents that did not use the hammer-and-chisel for removing bone surrounding impacted teeth, or for managing teeth adjacent to the impacted teeth when removing the impacted teeth accounted for 77.6%. The main reason cited is "Greater trauma," (120 dentists, accounting for 48.2%), followed by the "Higher risk," (51 dentists, accounting for 20.5%) (Table 2).

2.4 Current situation of the respondents

At this stage, although dental treatment is gradually resuming, tooth extraction, especially impacted mandibular third molar extraction, is still restricted. Among the 321 respondents, 249 dentists still currently perform tooth extractions, accounting for about 77.6%. Of the 249 dentists who still perform tooth extractions, only 160 perform extractions of impacted mandibular third molars, while the remaining 89 dentists do not perform extraction of impacted mandibular third molars. The main reason for not extracting impacted teeth is that "the high-speed handpiece cannot be used due to epidemic prevention," a total of 68 dentists, accounting for 76.4%. A secondary reason for not extracting impacted teeth is the high risk of surgical infection during the epidemic (14 dentists, 15.7%). Other factors include administrative orders and hospital requirements, accounting for 7.9% (Table 3). Among the 160 respondents who performed impacted wisdom tooth extraction, 37 would use the hammer chisel method, accounting for 23.1%, while the turbine method was 123, accounting for 76.9%. This ratio is roughly the same as the ratio of the first two methods used in the epidemic, and there is no significant difference (Table 4). Among the 129 private clinic practitioners, 18 did not resume performing tooth extractions, accounting for 14.6%, and 45 did not resume impacted mandibular third molar extractions, accounting for 34.9%. Among the 192 public hospital practitioners, 51 dentists reported that they had not resumed performing tooth extractions, accounting for 26.6%; and dentists from 113 hospitals reported that they had not resumed impacted mandibular third tooth extraction, accounting for 58.9%. The data are significantly different between public and private hospitals ($P < 0.05$), (Table 5).

For impacted teeth that needed urgent removal, 166 of the 321 respondents said that they would advise the patients to have the teeth removed after the epidemic; 137 respondents would immediately remove the teeth as an outpatient procedure, and the remaining 18 respondents would recommend patients be hospitalized or transferred to a hospital for removal.

2.5 Cognition and learning about different methods of removing resistance of adjacent teeth

Among the 321 respondents, 222 respondents had learned the hammer-and-chisel method during their clinical internship, accounting for 69.2%; 81 respondents had not studied the hammer-and-chisel method,

accounting for 25.2%; and the remaining 18 chose “Not sure,” (Figure 1a) as to whether they had learned the hammer-and-chisel method during their clinical internship in dental school. Regarding the necessity for learning the hammer-and-chisel method, 222 respondents thought that it was necessary, 63 respondents thought that it was not necessary, and the remaining 36 respondents were not sure (Figure 1b). By analyzing opinions in different age groups, we found that in the 51+ years age group, 50% of respondents would use the hammer-and-chisel method; however, no respondents reported that they had not learned the hammer-and-chisel method in dental school. In the 41–50 years age group, the usage rate of the hammer-and-chisel method fell to 23.5%, and the proportion of untaught increased to 11.7%. In the 31–40 years age group, the usage rate of the hammer-and-chisel method further decreased to 21.8%, while the proportion of untaught rose to 21.8%. In the youngest, 21–30 years age group, the usage rate of the hammer-and-chisel method is 18.2%, while the untaught rate is 31.8%. (Table 6).

As for the hammer-and-chisel method and the surgical bur technique used to remove surrounding bone in cases of bony tooth impactions, 192 respondents (59.8%) believed that the surgical bur technique was more efficient, 72 respondents (22.4%) believed that the hammer-and-chisel method was more efficient, and the rest, 57 respondents (17.8%), chose “almost” or “not sure”. On the question of which method is more invasive, 249 respondents believe that the hammer-and-chisel method is more invasive, 12 respondents believe that the surgical bur technique is more invasive, and the remaining 60 respondents chose “almost” or “not sure” (Table 7).

2.6 Basic Information of Follow-up

During the period of strict epidemic control in our hospital (i.e. 3.5-5.20), a total of 620 patients with impacted teeth visited our outpatient department, of which 583 met the inclusion criteria. The specific situation of impacted teeth, treatment plan and postoperative reaction are shown in Table 8. During the follow-up, the discomfort one week after the operation was scored as 0-10, 0 as no discomfort and 10 as very discomfort. A score of 0-10 represents the patient's satisfaction with the treatment (including the operation process and postoperative reaction). 0 is satisfied, and 10 is very satisfied. The specific results are shown in Table 8.

The results showed that there was no significant difference in discomfort and satisfaction of patients with different impacted teeth (except horizontal impacted teeth) extracted by hammer chisel or turbine one week after operation. For horizontally impacted teeth, the discomfort of hammer chisel method seems to be more obvious than that of turbine method. However, due to too few cases of hammer chisel method, statistical analysis can not be carried out.

The difference of discomfort and satisfaction of patients is mainly due to the influence of impacted teeth. Specifically, horizontal impacted teeth cause the most obvious discomfort and the lowest satisfaction, while vertical impacted teeth have the least discomfort and the highest satisfaction after extraction, and mesial and distal impacted teeth are in the middle.

3. Discussion

COVID-19 is an infectious disease that seriously endangers the health of the population. Its transmission route is mainly via respiratory droplets and close contact.[9] In addition, high concentrations of aerosols in confined spaces may also cause disease transmission [10]. This makes oral and maxillofacial surgery a greater risk for disease transmission. Many scholars believe that during the outbreak of the disease, elective oral surgery procedures should be suspended [11, 12].

During the COVID-19 outbreak, China has adopted the corresponding measures and achieved good results. These measures include: (1) monitoring the effectiveness of surface and equipment decontamination; (2) cleaning, disinfection, and sterilization; (3) restricting the use of aerosol-generating devices such as high-speed handpieces; (4) improving suction and evacuation during clinical procedures; (5) enhancing general building ventilation; (6) educating staff, patients, and all who enter the dental care facility to restrict behaviors that spread infections .

Although the epidemic has gradually stabilized, it still has an impact on clinical dental practice[13,14]. In our survey, 22.4% of respondents still do not perform or cannot perform ordinary tooth extractions, and more than half of the respondents cannot perform extractions of impacted teeth; the main reason cited is that use of the high-speed handpiece is contraindicated.

Compared with uncomplicated tooth extractions, the biggest difference with the extraction of impacted teeth is the need to surgically remove impacting bone and soft tissue, in order to facilitate atraumatic removal of the impacted tooth[11]. There are two main methods for removing impacting bone and soft tissue: the surgical bur technique and the hammer-and-chisel method. Many studies state that the surgical bur technique is less invasive, less risky, and saves more time compared to the hammer-and-chisel method . This makes the surgical bur technique more popular than the hammer-and-chisel method . About 75% of clinicians are more willing to use the surgical bur technique to remove impacting bone and soft tissue. In our survey, 77.6% of clinicians believe that the hammer-and-chisel method is more invasive. But in terms of efficiency, one-third of clinicians still believe that the hammer-and-chisel method is more efficient or comparable to the surgical bur technique. This seems to be somewhat different from the one-sided view of domestic literature. Combined with our own clinical experience, we believe that this disparity stems from differences in the rationale for indications and selection criteria for tooth extraction. For the lower position of the impacted mandibular third-molar, the surgical bur technique has obvious advantages [15], but for high-position mesoimpacted teeth, the clinical efficiency of the two techniques is equal, and even the hammer-and-chisel method makes for efficient removal of impacting bone and soft tissue. In our view, general comparisons of the surgical bur technique and the hammer-and-chisel method for tooth extraction do not accurately estimate the clinical efficiency between these techniques. The specifics of each clinical situation should be evaluated, and the merits of using the surgical bur technique and the hammer-and-chisel method should be compared based on clinical modeling.

Because the high-speed handpiece generates large amounts of aerosols, when high-speed handpieces are used in the oral cavity of patients with COVID-19, there is a high risk of generating large volumes of

infectious aerosols, thereby increasing the risk of the potential spread of COVID-19. Some studies advocate that manual surgical instruments should be used as much as possible in clinical dentistry, to reduce the generation of aerosols and thus reduce the risk of cross-infection [16]. From this perspective, the hammer-and-chisel method seems to have an advantage over the surgical bur technique in preventing the spread of COVID-19. In the current situation, if impacted teeth must be removed, the hammer-and-chisel method should be the preferred surgical option. Dental school curriculums overwhelmingly teach the surgical bur technique. Currently, during the COVID-19 pandemic, only 23% of respondents report using the hammer-and-chisel method, and 76.4% of respondents report that they are unable to perform impacted mandibular third-molar extractions. The reason is because of the inability to use the high-speed handpiece. This reflects the limitations of the surgical bur technique under certain circumstances. Our survey also shows that nearly 70% of the respondents think it is necessary to learn the hammer-and-chisel method. This conclusion shows that traditional surgical methods such as the hammer-and-chisel method should not be completely abandoned from the clinical curriculum for educating dental students in techniques for extraction of impacted mandibular third molars. In some cases, these methods do have clinical application value.

The respondents were divided into two groups: private clinics/hospitals and public hospitals. Private clinics/hospitals resumed clinical practice at a significantly higher rate than that of public hospitals. This result seems to reflect the stricter administrative requirements for public hospitals. The strict hospital requirements during the pandemic directly affected the operation of dental clinics. Of course, strict hospital control measures also mitigated the spread of COVID-19 in clinical dentistry. China has a large population and high demand for medical services. During the pandemic, each hospital implemented a strict patient appointment system, a pre-treatment disease screening system, and peri-treatment asepsis, decontamination, disinfection, and sterilization protocols, all of which reduced the risk of spreading COVID-19.

The COVID-19 pandemic generated many other risks[17-20]. For impacted teeth that urgently need to be extracted, about 40% of respondents report that they would immediately extract these teeth on an outpatient basis, and as many as 50% of respondents recommended that patients defer extraction of mandibular third-molars until after the pandemic. This development seems to highlight certain ethical risks.

Through follow-up, 60% of the impacted teeth cases in our hospital during the epidemic period were treated with effective operation at the first diagnosis, while the patients with completely impacted wisdom teeth were required to undergo elective operation, which reflected the limitation of the use of surgical instruments can substantially affected the decision-making of doctors. However, in the patients who received treatment, no matter hammer chisel method or turbine method, the discomfort of patients one week after operation was equal and at a low level, and the main factor affecting the discomfort of patients seemed to be the kind of impacted tooth. In terms of treatment satisfaction, no matter what method, patient satisfaction is at a high level, which may be due to the long-term suspension of medical activities, patients get treatment again, reducing the pickiness of patients on medical activities. These

results showed that under the condition of full understanding and communication, there seems to be no significant difference in patients' acceptance of hammer chisel method and turbine method.

When age and dental school education are factored into a comparison of the ratio of respondents who report using the hammer-and-chisel method and respondents who do not use the hammer-and-chisel method, we observe that when the age of the respondent decreases, the usage rate of the hammer-and-chisel method decreases. The proportion of dentists who have not studied the hammer-and-chisel method has increased. This reflects the current trend in clinical dental education. The surgical bur technique is considered to be an atraumatic method for impacted tooth extraction. The surgical bur technique is widely included in clinical dental curricula and is very popular with younger generations of dentists. The use of the hammer-and-chisel method has gradually faded in clinical use and is not included in the curriculum of most dental schools. As COVID-19 persists globally, the clinical application value of the hammer-and-chisel method as a low-aerosol-producing surgical method may be appreciated.

Limitations. There were several limitations in this study. Firstly, this study was only single-center study, another multiple center study was still needed in the future. Secondly, the sample size of this study was really limited, another larger study with more participants was necessary.

4. Conclusion

The COVID-19 pandemic significantly affected dentists' decisions whether to remove impacted mandibular third molars or not. In the current epidemic situation, the hammer-and-chisel method is recommended as a low-aerosol-producing option for the extraction of impacted mandibular third molars. Traditional methods such as the hammer-and-chisel method should not be completely eliminated from the clinical dental curriculum.

Abbreviations

Not applicable.

Declarations

Ethics approval and consent to participate

This study was conducted in accordance with the Declaration of Helsinki and approved by the ethics committee of school and hospital of stomatology, Wenzhou Medical University. Written informed consent was obtained from all participants.

Consent for publication

Not applicable.

Availability of data and materials

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

Competing Interests

All of the authors had no any personal, financial, commercial, or academic conflicts of interest separately.

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Not applicable.

Authors' contributions

WC conceived of the study, and XJ participated in its design and coordination and JY helped to draft the manuscript. All authors read and approved the final manuscript.

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Not applicable.

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Tables

Table 1. General Information

Group	Case	proportion
Sex		
Male	171	53.3%
Female	150	46.7%
Age		
21-30 years	63	19.6%
31-40 years	198	61.7%
41-50 years	48	15.0%
age over 51 year	12	3.7%
Working years		
0-5 year	81	25.2%
6-10 year	120	37.4%
11-20 year	90	28%
age over 20 year	30	9.4%
Educational background		
Specialized subject	45	14.0%
undergraduate	114	35.5%
Postgraduates	147	45.8%
Doctoral candidate	15	4.7%
Unit nature		
Private clinics or hospitals	129	40.2%
Public stomatological hospital	72	22.4%
Stomatology Department of public general hospital	120	37.4%

Table 2. Selection of methods for removing the resistance of adjacent teeth of impacted wisdom teeth

	Number of people	proportion
Is hammer chiseling used		
yes	72	22.4%
no	249	77.6%
Main reasons for not using		
Great trauma	120	48.2%
High risk	51	20.5%
can't	44	17.7%
Unskilled	34	13.7%

Table 3. Current status of tooth extraction

	Number of people	proportion
Whether to have a tooth extraction		
no	72	22.4%
Yes	249	77.6%
Whether to remove the impacted wisdom tooth		
no	160	64.3%
Yes	89	35.7%
Do not pull out the main reason of the impacted wisdom teeth		
Turbines cannot be used because of COVID-19	68	76.4%
Risky operation	14	15.7%
Other reasons (executive order, etc.)	7	7.9%
The main way to remove the adjacent tooth resistance is to remove the impacted wisdom tooth		
Method of turbine		
Method of turbine	123	76.9%
Hammer chisel method	37	23.1%

Table 4. Proportion of hammer chiseling before and after epidemic situation

	Before the outbreak	After the outbreak
Number of respondents with wisdom teeth removed	321	160
Using hammer chiseling	72	37
Proportion	22.4%	23.1%
P*	0.908	

*chi-square test

Table 5. Different properties of units tooth extraction status

Unit nature	Private clinics or hospitals	Public hospitals	P Value
Number of people interviewed	129	192	
Number of people undergoing tooth extraction	111 86.0%	141 73.4%	P<0.01*
Number of impacted wisdom teeth extracted	84 65.1%	79 41.4%	P<0.01*

*chi-square test

Table 6. Application of chiseling method in different age groups

Age group	21-30 years	31-40 years	41-50 years	Over 51 years old
Total number of people	66	192	51	12
Number of people using chiseling method	12	42	12	6
proportion	18.2%	21.8%	23.5%	50%
Number of people who have not learned chiseling method	21	42	6	0
proportion	31.8%	21.8%	11.7%	0%

Table 7. The cognition of different methods to relieve resistance of adjacent teeth

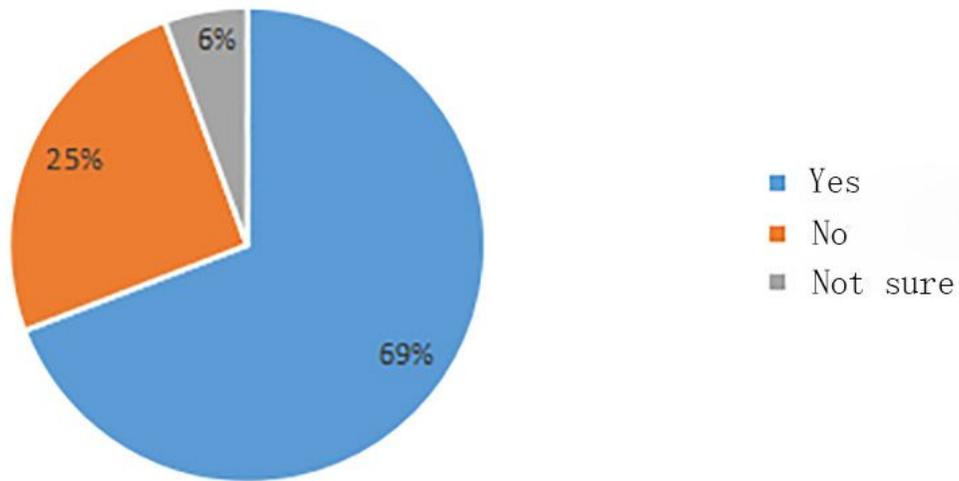
	Number of people	proportion
Which resistance relief method is efficient		
Method of turbine	192	59.8%
hammer-and-chisel method	72	22.4%
almost	33	10.3%
not sure	24	7.5%
Which resistance relief method is more traumatic		
hammer-and-chisel method	249	77.6%
Method of turbine	12	3.7%
almost	27	8.4%
not sure	33	10.3%

Table 8. Follow up the basic information of the patients

Impacted type		distal impacted	mesial impacted	horizontal impacted	vertical impacted	Completely ambush
Case		15	288	58	200	22
Elective removal		7	92	30	20	22
First visit removal		8	196	28	180	0
hammer-and-chisel method/ removal number at first visit		2/8	125/196	1/28	6/180	0
Turbine method/ removal number at first visit		6/8	71/196	27/28	15/180	0
Average discomfort of patients with different methods in one week after tooth extraction 0-10	hammer-and-chisel method	2.5	2.64	5	2.16	-
	turbine method	2.33	2.59	3.11	2.07	-
	NA	-	-	-	2.01	-
	Average value	2.37	2.58	3.18	2.02	-
Patient satisfaction with different methods 0-10	hammer-and-chisel method	8.5	8.62	6	7.67	-
	turbine method	8.67	8.57	8.51	8.53	-
	NA	-	-	-	8.80	-
	Average value	8.63	8.60	8.42	8.74	-

Figures

a



b

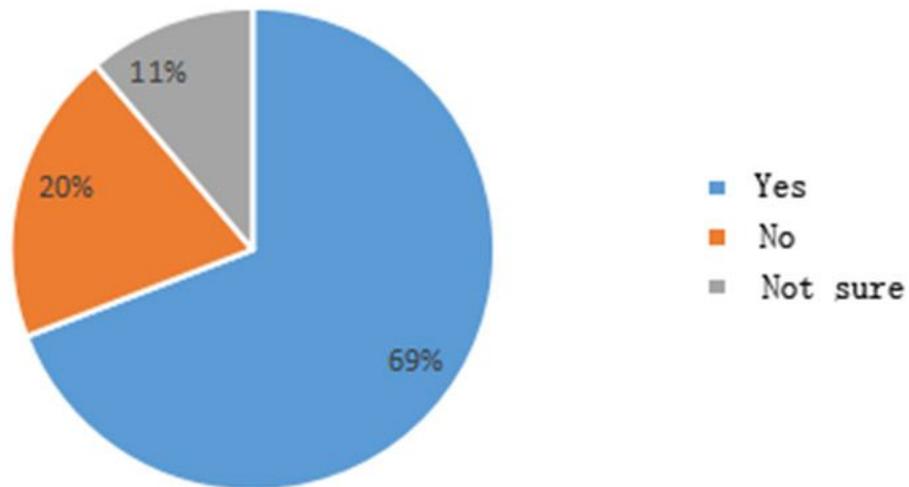


Figure 1

a: Investigation on whether the hammer-and-chisel method has been learned during the clinical practice.

b: Investigation on the necessity for learning hammer-and-chisel method.

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- [Questionnaire.docx](#)