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Article

Effects of Impacted Third Molars Extraction on Periodontal Status of Second Molar and Oral Health-Related Quality of Life

Tie-lou Chen [1,2,*], Pei Wang [1], Shi-feng Wang [2,3,*], Yan-en Wang [1], Xin-hai Zhang [1], Wen-jing Chen [1], An-xin Yue [1], Dao Xiang [3], Xu Feng [3]

[1] Department of Periodontology, Military Oral Health Center of Changhai Hospital, Affiliated to Naval Medical University, Shanghai 200081, China

[2] Key Medical laboratory of Chinese PLA

[3] Naval Special Medical Center, Affiliated to Naval Medical University, Shanghai 200433, China

[*] Correspondence: Tie-lou Chen (chentielou2010@163.com); Shi-feng Wang (156362518@qq.com)

Abstract: Objective: The study investigated the impacts of third molar (M3) extraction on periodontal status of adjacent second molar (M2) and oral health-related Quality of life (QoL). **Methods:** 272 cases with M3 were randomly divided into treatment group and control group, each of 136 cases. Questionnaire survey evaluated demographic features of the subjects. Gingival index (GI), plaque index (PLI) and conscious symptoms of adjacent teeth of the M3 were detected in both groups at baseline (T0), 1 week (T1), 1 month (T2) and 6 months (T3) after treatment. The impacts of QoL were evaluated using OHIP-14 to measure total scores and various items of OHIP-14 at different observation point. **Results:** The percentage of swelling and toothache in the treatment group was significantly lower than that in the control group at T1, T2 and T3. Significant differences could be seen in GI and PLI between the treatment and control groups at T2 and T3. The total score of OHIP-14 in T2 and T3 was significantly lower than that in T0 and T1 in the treatment group. The 14 items scores and the percentage of positive reaction in the treatment group were significantly lower than those in the control group at T2 and T3. **Conclusion**: M3 extraction had significant impacts on the periodontal status of the second molar and quality of life. This study would provide an important basis for the prophylactic removal of M3 in clinical work.

Keywords: Impacted Third Molar; Tooth Extraction; Periodontal Status; Quality of Life; Prophylactic Treatment

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1. Introduction

Pericoronitis of third molar (M3) is the most common oral disease in young adults. With the increase of life pressure of young people, the incidence of pericoronitis and periodontitis has increased significantly. Different opinion had reported on the rationality of prophylactic removal of impacted M3. [1] Li Z [2] showed that prophylactic extraction of M3 reduced its effect on adjacent teeth and alveolar bone resorption.[3] Evidence showed that prophylactic removal of M3 in adolescents did not prevent the incisor crowding. However, no evidence supported prophylactic removal of impacted M3 in adults.[4] There is also no specific scheme to evaluate the impact of M3 removal on the periodontal status of adjacent second molar (M2) and oral health-related quality of life (QoL).

Oral health impact profile-14 (OHIP-14) is composed of 14 items in 4 dimensions, namely dysfunction, pain, discomfort, disability or disability. It involves all aspects of oral

health and may damage the physical, psychological and social welfare of patients.[5] Xin W et al [6] verified that the Chinese version of OHIP-14 had good reliability and validity for Chinese population.

Whether M3 is removed has been a controversial issue among scholars. Therefore, this study explored the effect of M3 extraction on the inflammatory state of the second molar and QoL through clinical trials. Furthermore, we hypothesized that prophylactic removal of M3 would significantly reduce the impact of M3 on the periodontal status of M2 and QoL. This study evaluated the short and long-term effects of the removal of impacted M3 on the periodontal status of adjacent M2 and QoL in our periodontal department. It will provide an important basis for preventive M3 removal in clinical work. This study evaluated the short- and longer-term effects of removal of impacted M3 on the periodontal status of adjacent M2 and QoL in our department of periodontal. This study will provide an important basis for the prophylactic removal of M3 in clinical work.

2. Materials and Methods

2.1. Ethical aspects

This study was performed in accordance with the World Medical Association Declaration of Helsinki (2008), and it was approved by the Ethics Committee of Shanghai Changhai Hospital, Naval Medical University (CHEC2019-091). And the clinical trial has been registered (CHCT 2019.2.10). All participants signed informed consent before participating in any part of the research.

2.2. Patients collection

278 patients came to our periodontal department for treatment due to swollen gums caused by M3 and were selected as the study subjects, of which 272 patients (266 males and 6 females, with an age of 19-43 years, averaging 33.5 years) were included in the study, and 6 patients were excluded because they did not meet the inclusion criteria. The patients were randomly divided into two groups, the treatment group and the control group, with 136 patients in each group. The patients in the former group had M3 extraction after acute inflammation was controlled, while the subjects in the latter group were treated with chlorhexidine gargle, 3 times a day for a week. All patients received oral hygiene education at the first visit.

2.3. Inclusion and exclusion criteria

Inclusion criteria were as follows: (1) Patient was clinically and X-ray confirmed to have impacted M3, and at least one quadrant had impacted M3 partially or completely erupted. (2) The patient had a history of food impaction between M3 and second molar, and had swollen gums due to M3 at least once in the past year, hoping to have M3 extracted. (3) The second molar adjacent to the impacted M3 has no obvious caries or loss. (4) A minimum of 20 remaining teeth in their mouths. (5) Patients received oral hygiene education during follow-up. (6) All patients were able to complete the normal questionnaire survey. **Exclusion criteria included:** (1) Patients had serious systemic disease. (2) Patients take antibiotics, hormones, or non-steroidal anti-inflammatory drugs or anticoagulant drugs within the past three months. (3) patients had a history of drug allergy.(4) patients had psychological or mental illness. (5) Patients were heavy smokers or drinkers. (6) Lactating or pregnant.

2.4. Periodontal clinical parameter measurement

The periodontal status of M2 adjacent to M3 were recorded at baseline (T0), 1 week (T1), 1 month (T2) and 6 months (T3) after treatment, including the measurement of gingival index (GI) [7] and plaque index (PI) [8] at 6 sites of each tooth. All data were

collected by the same dentist, who calibrated the repeated measurements of five patients before the study to ensure the consistency of periodontal condition data collection. [9]

2.5. Impact on quality of life

The patients' QoL was measured using the Chinese version of OHIP-14 questionnaire at T0, T1, T2 and T3, [6] which was applied via standardized interview to avoid different interpretations among patients and minimize its subjectivity. The evaluation of various items included 5 levels of scores (0 = never, 1 = very little, 2 = sometimes, 3 = often, 4 = always), and total scores of the 14 items were calculated in the process. When the choices of "sometimes" "+", "often" "+" and "always" "+" were taken as the positive reactions of the items, and the rate of positive reactions in patients were calculated. While the choices of "never" "-" and " hardly never" "-" were regarded as negative reactions of the items.[10]

2.6. Demographic features and conscious symptoms examination

Complete relevant inspection scale, including gender, age, race, education level, oral hygiene, smoking, regular dental examination and other demographic indicators (Table 1). As well as the complications associated with M3, such as gum swelling and toothache of M2 were measured respectively at T0, T1, T2 and T3. The answer to conscious symptoms is either "yes" or "no". The questionnaire survey forms completed by patients themselves.[11]

2.7. Statistical analysis

Statistics was performed using the SPSS 16.0 software (SPSS Inc, Chicago, IL,USA). The frequency distribution of demographic descriptive variables was used to identify respondents' profiles, and to compute the mean and standard deviations for patient satisfaction. Positive reaction percentage of each items, and the percentage of swelling and toothache at different observation points was analyzed by X^2 test. Paired comparison between the two groups was corrected by Bonfferni, and variance analysis was used to compare differences in total scores of the OHIP-14，the scores of each item, and GI and PLI between the two groups at different observation points. The level of significance was set at $P< 0.05$.

3. Results

3.1. Features of the study population

The detailed features showed in Table 1 (Table 1).

3.2. Effects of M3 extraction on the total scores and various items scores of OHIP-14

Significant differences could be noted of the total scores of OHIP-14 and the scores of various items in T2 and T3, as compared with those in T0 and T1(P <0.01) in the treatment group, and no significant difference of OHIP-14 scores between T1 and T0. While the total scores of OHIP-14 and the scores of various items for the control group at T1 significantly decreased as compared with those of T0, and no significant difference of those at T2 and T3, as compared with those of T0 (Table 2, 3,Figure 1).

Table 1. Features of the study population, n (%)

Features	Treatment group(N=136)	Control group(N=136)
Gender		
Male	133(97.79)	133(97.79)
Female	3(2.21)	3(2.21)
Age (yr)		
≦20	36(26.47)	38(27.94)
21-30	71(52.21)	69(50.74)
31-40	25 (18.38)	23(16.91)
≥41	4 (2.94)	6(4.41)
Race		
Han nationality	136(100)	136(100)
Educational level		
Primary school	16(11.76)	16(11.76)
High school	41(30.15)	39(28.68)
Bachelor degree or higher level	79(58.09)	81(59.56)
Oral hygiene		
Good	31 (22.79)	29(21.32)
Bad	105 (77.21)	107(78.68)
Smoking		
Yes	76 (55.88)	77(56.62)
No	60 (44.12)	59(43.38)
Regular dental check		
Yes	20 (14.71)	19(13.97)
No	116 (85.29)	117(86.03)
History of toothache due to M3		
Yes	86(63.24)	83(61.03)
No	50(36.76)	53(38.97)
Seeking M3 surgery due to toothache		
Yes	117 (86.03)	115(84.56)
No	19 (13.97)	21(15.44)
Impact M3 type		
Soft tissue	111(81.62)	107(78.68)
Hard tissue	25(18.38)	29(21.32)
Obvious infection after M3 removal		
Soft tissue	6(5.41)	(–)
Hard tissue	4(16.00)	(–)

Table 2. Comparison of the total scores of OHIP-14 and the scores of various items at different points in the treatment group ($N = 136,\ \bar{X} \pm S$)‡

Items	observation point			
	T0	T1	T2	T3
Total scores of OHIP-14	31.62±7.53	32.69±10.11	9.25±4.33**	3.79±2.15**##
Pronunciation trouble	1.50±0.22	1.49±0.42	0.71±0.18*	0.35±0.10*
Poor taste	1.60±0.54	1.61±0.54	0.43±0.10*	0.25±0.13*
Obvious pain	3.80±0.31	4.01±1.60	0.63±0.12**	0.19±0.10**
Sense of discomfort when eating	3.70±0.21	3.93±1.15	1.22±0.11**	0.55±0.10**
Sense of uneasiness before others	1.80±0.30	1.77±0.41	0.63±0.10*	0.30±0.10*
Sense of nervousness	1.70±0.33	1.69±0.35	0.66±0.10*	0.25±0.10*
Dissatisfaction with meals	2.71±0.23	2.80±1.20	0.42±0.11**	0.10±0.05**
Halfway stop while eating	3.51±0.27	3.55±0.48	0.93±0.19**	0.65±0.10**
Unable to have good rest	3.32±0.25	3.65±1.45	0.41±0.10**	0.10±0**
Experience of embarrassment	1.72±0.22	1.76±0.45	0.68±0.11*	0.30±0.10*
Easy to lose temper with others	1.68±0.10	1.76±0.55	0.60±0.15*	0.25±0.05*
Difficult to finish daily work	1.55±0.17	1.58±0.34	0.30±0.10*	0.10±0.10*
Sense of dissatisfaction with life	1.54±0.18	1.60±0.25	0.81±0.15*	0.25±0.15*
Unable to do anything	1.49±0.20	1.49±0.20	0.82±0.19*	0.15±0.10*

**Significant differences were noted between the T2 or T3 and T0 or T1, * P<0.05, ** P<0.01. ##Significant differences were noted between T3 and T2, P<0.01. ‡Numbers are mean ± standard error of the mean.*

Table 3. Comparison of the total scores of OHIP-14 and the scores of various items at different points in the control group ($N = 136,\ \bar{X} \pm S$)‡

Items	observation point			
	T0	T1	T2	T3
Total scores of OHIP-14	31.55±8.15	19.34±5.23**	24.10±4.90*#	27.80±5.66#
Pronunciation trouble	1.48±0.43	0.87±0.21*	1.08±0.30*	1.20±0.36
Poor taste	1.56±0.45	0.96±0.50*	1.19±0.41*	1.23±0.55
Obvious pain	3.81±0.35	2.65±0.20**	3.32±0.28*	3.59±0.98
Sense of discomfort when eating	3.69±0.20	2.35±0.20**	2.88±0.51*	3.28±1.01
Sense of uneasiness before others	1.81±0.45	1.01±0.30*	1.35±0.30*	1.50±0.30
Sense of nervousness	1.72±0.28	1.13±0.31*	1.42±0.41*	1.54±0.53
Dissatisfaction with meals	2.72±0.21	1.79±0.40*	2.18±0.23*	2.39±0.51
Halfway stop while eating	3.50±0.32	2.59±0.20*	2.66±0.50*	3.21±1.20
Unable to have good rest	3.30±0.40	2.11±0.30**	2.45±0.33*	2.99±0.71
Experience of embarrassment	1.73±0.55	0.89±0.45*	1.05±0.40*	1.44±0.60
Easy to lose temper with others	1.69±0.40	0.78±0.30*	1.18±0.20*	1.41±0.41
Difficult to finish daily work	1.56±0.45	0.79±0.45*	1.20±0.55*	1.37±0.55
Sense of dissatisfaction with life	1.50±0.38	0.68±0.30*	1.09±0.28*	1.35±0.38
Unable to do anything	1.48±0.27	0.74±0.40*	1.05±0.40*	1.30±0.32

**Significant differences were noted between T1 or T2 or T3 and T0, * P<0.05, ** P<0.01. #Significant differences were noted between T2 or T3 and T1, P<0.05. ‡Numbers are mean ± standard error of the mean.*

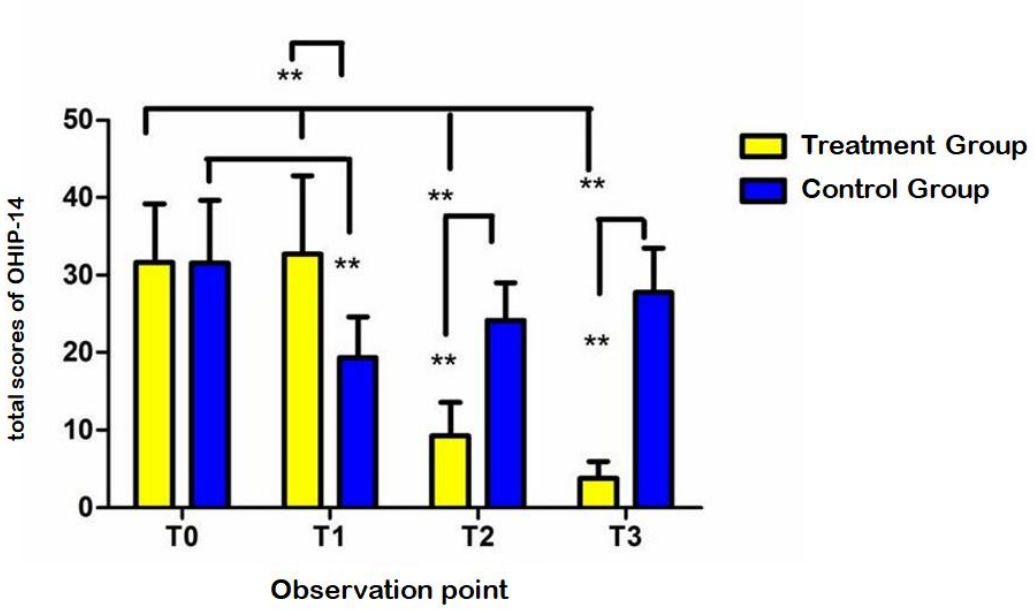

Figure 1. Comparison of the total scores of OHIP-14 between two groups at different observation point. * P<0.05, ** P<0.01 compared with other observation point or control group.

3.3. Effects of M3 extraction on the positive reactions distribution frequency of various items of OHIP-14

As shown in tables 4 and 5, the distribution frequency of positive reactions of various items in the treatment group at T1, T2 and T3 significantly lower as compared with that of T0 ($p<0.01$ or $p<0.05$). In the control group, the distribution frequency of positive responses of various items at T1 significantly lower as compared with that of T0, and no significant difference of the distribution frequency of positive reactions at T3 as compared with that of T0.

Table 4. Comparison of the positive reaction frequency of various OHIP-14 items in the treatment group at different points (N=136)

Items	Observation point, n (%)			
	T0	T1	T2	T3
Pronunciation trouble	19(13.97)	13(9.6)*	2(1.5) **#	0(0)**#
Poor taste	20(14.71)	15(11.0)*	2(1.5) **#	0(0)**#
Obvious pain	136(100)	44(32.4)**	4(2.9) **##	0(0)**##
Sense of discomfort when eating	136(100)	46(33.8)**	8((5.9) **##	0(0)**##
Sense of uneasiness before others	67(49.26)	29(21.3)*	6(4.4)**##	0(0)**##
Sense of nervousness	25(18.38)	16(11.8)*	4(2.9)**#	0(0)**##
Dissatisfaction with meals	59(43.38)	37(27.2)*	4(2.9)**##	0(0)**##
Halfway stop while eating	119(87.50)	46(33.8)**	4(2.9)**##	0(0)**##
Unable to have good rest	131(96.32)	45(33.1)**	4(2.9)**##	0 (0)**##
Experience of embarrassment	20(14.71)	17(12.5)*	6(4.4)**#	0(0)**#
Easy to lose temper with others	53(38.97)	30(22.1)*	6(4.4)**##	2(1.5)**##
Difficult to finish daily work	60(44.12)	45(33.1)*	4(2.9)**##	0(0)**##
Sense of dissatisfaction with life	55(40.44)	41(30.1)*	4(2.9)**##	0(0)**##
Unable to do anything	21(15.44)	15(11.0)*	4(2.9)**#	0(0)**#

Significant differences were noted between T1 or T2 or T3 and T0, * P<0.05, ** P<0.01. #Significant differences were noted between T2 or T3 and T1, #P<0.05, ## P<0.01.

Table 5. Comparison of the positive reaction frequency of various OHIP-14 items in the control group at different points (N=136)

Items	Observation point n (%)			
	T0	T1	T2	T3
Pronunciation trouble	18 (13.24)	10 (7.35) *	14 (10.3)	15 (11.00)
Poor taste	19 (13.97)	10 (7.35) *	12 (8.8)	15 (11.00)
Obvious pain	136(100)	68 (50.00) **	100(73.53)*	110(80.88)#
Sense of discomfort when eating	136(100)	69 (50.74) **	99(72.79)*	105(77.21)#
Sense of uneasiness before others	66(48.53)	23(16.91)*	42(30.9)*	45(33.09)
Sense of nervousness	26(19.12)	20(14.71)*	14(10.3)	18 (13.24)
Dissatisfaction with meals	60(44.12)	28(20.59)*	40(29.4)*	44(32.35)
Halfway stop while eating	118(86.76)	60(44.12)**	78(57.4)*	106(77.94)#
Unable to have good rest	130(95.59)	55(44.44)**	82(60.2)*	109(80.15)#
Experience of embarrassment	21(15.44)	8(5.88)*	10(7.4)	17(12.50)
Easy to lose temper with others	54(39.71)	34(25.00)*	44(32.4)	45(33.09)
Difficult to finish daily work	62(45.59)	44(32.35)*	54(39.7)	54(39.71)
Sense of dissatisfaction with life	56(41.18)	40(29.41)*	52(38.2)	52(38.24)
Unable to do anything	20(14.71)	9(6.62)*	12(8.8)	17(12.50)

Significant differences were noted between T1 or T2 or T3 and T0, * P<0.05, ** P<0.01. #Significant differences were noted between T3 and T1, P<0.05.

3.4. Effects of M3 extraction on gum swelling and toothache

The percentages of gum swelling and toothache in the treatment group at T1 (44.85% and 43.38%), T2（2.94% and 2.20%) and T3 (0.74% and 1.47%) were significant lower than those of T0 (84.56% and 86.76%) ($p<0.01$). However, no significant difference could be found in the percentage of swelling and toothache at T3, as compared with those of T2. The percentages of gum swelling and toothache in the control group at T1 (65.44% and 63.97%) were significantly lower than those of T0 (82.35% and 87.50%) ($p < 0.05$). Nevertheless, there was no significant difference at T2 (73.59% and 74.79%) and T3 (78.68% and 80.15%), as compared with those of T0 (Figure 2 and Figure 3).

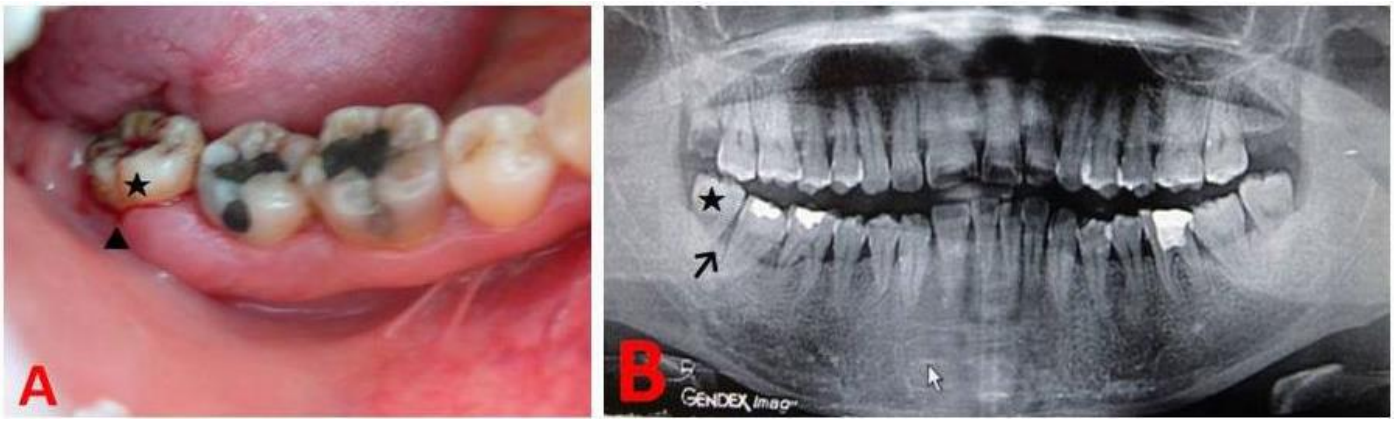

Figure 2. The clincal and panoramic observation. A. Clinical photograph of M3. B. X-ray image of M3. M3 (★), gum swelling (▲), interdentium and bone resorption between M3 and M2 ( ).

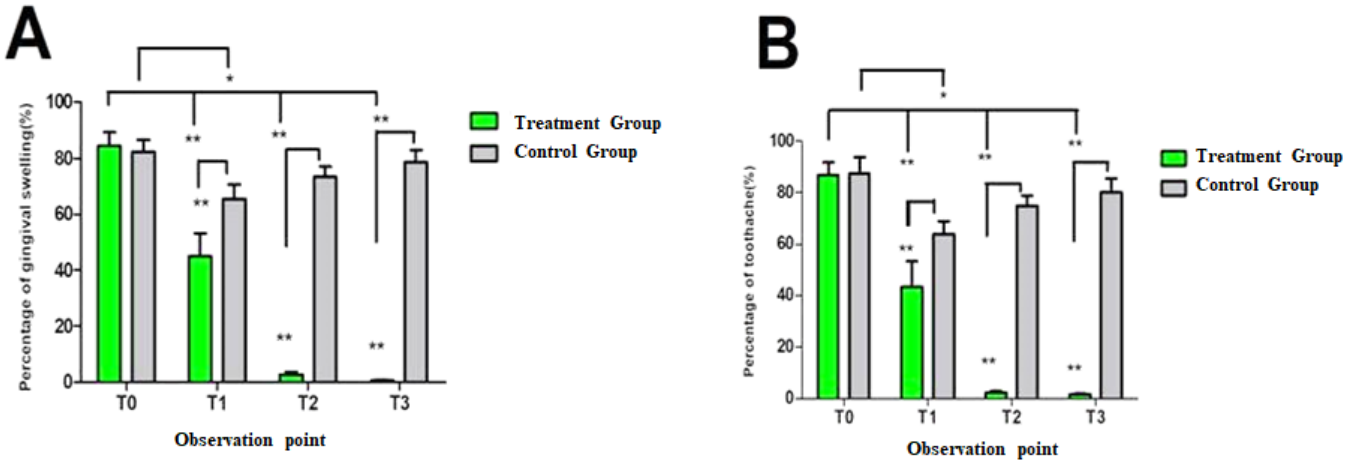

Figure 3. Comparison of the percentage of gingival swelling and toothache between two groups at different observation point. A. Gingival swelling; B. Toothache. * P<0.05, ** P<0.01 compared with other observation point or control group.

3.5. Effects of M3 extraction on periodontal clinical indices of M2

The GI and PLI of the treatment group significantly improved at T2 and T3, as compared with those of T0 and T1 (p<0.01). However, no significantly difference of the GI and PLI at T1, as compared with those of T0. The GI and PLI of the control group obviously improved at T1, as compared with those of T0 (*P* <0.05). However, no significantly difference of the GI and PLI at T2 and T3, as compared with those of T0 (Figure 4).

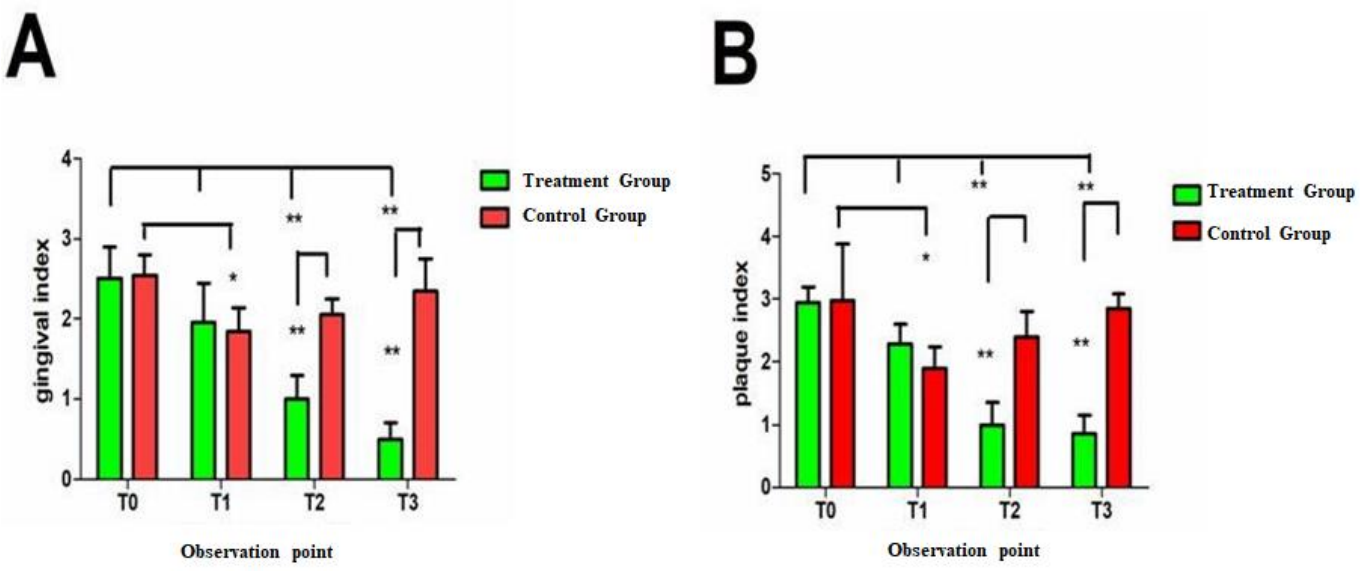

Figure 4. Comparison of the GI and PLI between two groups at different observation point. A. GI; B. PLI. * P<0.05, ** P<0.01 compared with other observation point or control group.

4. Discussion

Third molar (M3) impaction is the most commonly clinical symptom in young adult, and pericoronitis of M3 displays the symptoms of gingival swelling, toothache and ozostomia, seriously affecting chewing, outward appearance and language function. Literature report is very limited regarding the effects of M3 extraction on periodontal status of second molar (M2) and QoL. However, the evidence suggested that retained M3

was associated with an increased risk of adjacent M2 and the QoL,[12] and the M3 is an important risk factor for adjacent M2 to develop periodontitis.[13] Elter JR showed that the presence of M3 was twice as likely to detect a depth of 5 mm around the adjacent M2. [14] And 43% of M3 in one year resulted in M3 pericoronitis[15] and 37% of patients had "toothache and swelling" associated with M3 disorder. [16]

Recently, quantifying the extent to which oral diseases affect physiological function, psychosocial well-being and subjective symptoms has developed.[17] A number of patients wish to be informed about the impact of surgical intervention on wellbeing, including physical, psychological and social aspects.[18] Pericoronitis characterized by gum swelling and toothache may affect mastication, aesthetics and language function. Patients had severe anxiety impacting curative effects on M3 surgery. [19]

Chen TL showed that crown bridge splint fixed loose teeth significantly improved curative effect of periodontal health and QoL.[11] Brauchle F[20] reported that the OHIP value decreased from 14.4 to 5.5, six months after cleaning and curettage, and the QoL of the patients was improved. The M3 was an important risk factor for periodontal health of adjacent M2, and the removal of M3 would not affect the occlusal function of teeth.[21] Slade GD[22] reported that 178 of the 480 patients with M3 disorder wished to have their M3 removed due to swelling and toothache, and three times more of them removed their M3 as compared with asymptomatic patients. In 2011, a survey of 6 793 people by Garaas R[23] found that one in three of them had M3 disorder, and 89 percent of them had periodontal disease, and the pericoronitis of M3 could affect the health of adjacent teeth. [24]

With the increase of life rhythm and stress, the acute attack of pericoronitis often affects people's life and work. Because the immunity of the human body decreased while the stress increased, the anaerobic bacteria increased in the gingival crevicular,[25] the rate of inflammatory response of the M3 obviously increased. And leading to the pericoronitis of the M3 and the swelling and toothache increased thus affected the life and work of the people.[26] Therefore, M3 extraction was of great significance to relieve the symptoms of gum swelling and toothache. Our findings demonstrated that the total scores of OHIP-14, as well as GI and PLI, and the percentages of swelling and toothache of adjacent M2 were pronouncedly reduced at T2 and T3 in the treatment group. At baseline, 8 of the 14 items had a positive reaction rate of more than 40 %, and the positive rate was significantly reduced at T2 and T3 after M3 extraction. In our study, most of the people wish to extract M3. Poor oral hygiene increased the risk of pericoronitis of M3. In fact, prophylactic M3 removal was generally accepted in USA military patients after a return visit to remove M3 from asymptomatic army patients.[27]

Because of the increase of mental pressure of the people in modern society, the immunity is reduced and psychological changes, resulting in an increase in the incidence of M3 pericoronitis. [28] Our findings showed that the percentage of gum swelling and toothache decreased significantly in the treatment group at 6 months after M3 extraction, and the GI and PLI significantly decreased than that of baseline.

In this study, some patients exhibited inflammatory response to influence the periodontal status of M2 and QoL in the first week after M3 extraction, they had a significant improvement in 6 months after surgery. In the study, most of the patients had better healing post-operation, and few patients showed obvious infection after M3 extraction and disappeared within one week.

5. Conclusion

From the limited data in this study, although the gingival index and plaque index of M2 did not show significant difference at first week after M3 extraction when compared with the control group, this may be related to the inflammatory reaction of tooth extraction. However, 1-month and 6-month follow-up after M3 extraction showed that the incidence of gingival redness and swelling, toothache, and periodontal clinical index of

M2 were significantly reduced, and their oral health-related Quality of life was significantly improved. The finding would provide an important basis for the prophylactic removal of M3 in clinical work.

Disclosure

None

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