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ORIGINAL ARTICLE

Oral health-related quality of life following third molar surgery with or without application of ice pack therapy

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Abstract
Aim To evaluate the effect of ice pack therapy on oral health-related quality of life (OHRQoL) following third molar surgery.
Methods All consecutive subjects who required surgical extraction of lower third molars and satisfied the inclusion criteria were randomly allocated into two groups. Subjects in group A were instructed to apply ice packs directly over the masseteric region on the operated side intermittently after third molar surgery. This first application was supervised in the clinic and was repeated at the 24-h postoperative review. Subjects in group A were further instructed to apply the ice pack when at home every one and a half hours on postoperative days 0 and 1 while he/she was awake as described. Group B subjects did not apply ice pack therapy. Facial swelling, pain, trismus, and quality of life (using Oral Health Impact Profile-14 (OHIP-14) instrument) were evaluated both preoperatively and postoperatively. Postoperative scores in both groups were compared.
Results A significant increase in the mean total and subscale scores of OHIP-14 was found in both groups postoperatively when compared with preoperative value. Subjects who received ice pack therapy had a better quality of life than those who did not. Subjects whose postoperative QoL were affected were statistically significantly higher in group B than in group A at all postoperative evaluation points ($P < 0.05$). Statistically significant differences were also observed between the groups in the various subscales analyzed, with better quality of life seen among subjects in group A.
Conclusions Quality of life after third molar surgery was significantly better in subjects who had cryotherapy after third molar than those who did not have cryotherapy. Cryotherapy is a viable alternative or adjunct to other established modes of improving the quality of life of patients following surgical extraction of third molars.

Keywords Oral health-related quality of life · Third molar surgery · Ice pack therapy

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Introduction

The quality of life model emerged as an important outcome of health care in the 1970s [1]. The expression "quality of life," though now often acknowledged, is difficult to define [1]. Quality of life (QoL) is a multifaceted concept that may be surmised as the patients' evaluation of the effects of disease and its treatment on satisfaction or dissatisfaction with their daily life, including physical, psychological, and social well-being [2]. Perceived poor health or presence of disease does not inexorably mean poor quality of life; this is partly due to its subjective nature [3]. QoL is not static and therefore changes over time to indicate improvements or deterioration in an individual's health status [3, 4].

There is growing recognition of the impact of oral that oral disorders may have considerable effect on patients' quality of life statuses [5]. The surgical removal of the mandibular third molars is one of the most frequently performed dento-alveolar procedures in oral and maxillofacial surgery [6]. Surgical extraction of mandibular third molars, whether therapeutic or prophylactic, is frequently performed on outpatient basis.

Studies have shown that a recovery period is required before patients can resume their usual lifestyle [7]. Post surgery, a cascade of events signaled by the onset of inflammation result in functional and structural changes within the surrounding soft tissues which is often expressed as pain, swelling, and trismus [8, 9]. These expected sequelae influence the patients' QoL in the immediate postoperative period [2, 8, 9].

Many questionnaires have been developed by various researchers to measure oral health-related quality of life [7, 10]. These include 16-item UK oral health-related quality of life (OHQoLUK-16), oral index disease profile (OIDP), Oral Health Impact Profile (OHIP), dental impacts on daily living (DIDL), and Geriatric Oral Health Assessment Index (GOHAI). The Oral Health Impact Profile-14 (OHIP-14) which was synthesized from the OHIP is becoming an important tool in the evaluation of oral health-related quality of life (OHRQoL). The OHIP-14 has 14 items which are organized into seven subscales; each subscale addresses aspects of oral health that may affect patients' general well-being [5, 11]. The OHIP-14 questionnaire has 14 items intended to measure subjective functional limitation, discomfort, and disability ascribed to oral conditions or its treatment. The OHIP-14, though a relatively short questionnaire, has been shown to be reliable, sensitive to changes, and to have adequate cross-cultural consistency [11, 12].

Cryotherapy, which is the therapeutic application of cold to remove heat from the body, is used routinely in sports medicine for its beneficial effects, including a reduction in levels of inflammation and pain [13–15]. Cryotherapy results in a decrease in the local temperature, which, in turn, leads to vasoconstriction and reduction in metabolic rates [8, 16, 17]. The magnitude of postoperative trismus, swelling, and pain has been correlated with patients' quality of life following third molar extraction [7, 9, 10]. Cryotherapy has been shown to reduce the severity of posttraumatic inflammation; therefore, an application of this technique may result in better patient quality of life following surgical extraction of impacted mandibular third molars [18].

Therefore, the aim of this study was to evaluate the effect of ice pack therapy on OHRQoL following third molar surgery. The study was based on the "null hypothesis" that there is no difference in quality of life of subjects who receive cryotherapy and those who do not receive cryotherapy following lower third molar surgical extractions.

Patients and methods

This study was approved by the Lagos University Teaching Hospital Health, Research and Ethics Committee. It was a prospective randomized controlled clinical study to evaluate the effect of ice pack therapy on OHRQoL following mandibular third molar surgery. All subjects were at least 18 years old and ASA classification 1. Subjects with contraindications to the use of cryotherapy (cold intolerance, Raymaud's disease, cold urticaria, cryoglobulinemia, history of pyoderma gangrenosum) were excluded. In addition, subjects with positive history of allergy to any of the drugs used in the study were excluded. Subjects were randomly allocated into two groups (groups A and B). Group A consisted of subjects who received cryotherapy, while group B consisted of subjects who did not have cryotherapy. Immediately after surgery, subjects in group A were instructed to apply ice packs (blocks of ice enveloped by crepe bandage to protect the skin) directly over the masseteric region on the operated side intermittently, as tolerated by the subject for 30 min (Fig. 1). This first application was supervised in the clinic. This was repeated at the 24-h postoperative review in the clinic. The subjects were also instructed to apply the ice pack when at home every one and a half hours on postoperative days 0 and 1 while he/she was awake as described.

All subjects received amoxicillin 500 mg orally every 8 h for 5 days, metronidazole 200 mg orally every 8 h for 5 days, and ibuprofen 200 mg per oral immediately after the surgery and then every 8 h for 3 days. All surgeries were performed by the same surgeon.

A written informed consent was obtained from each subject after the subjects were duly informed about the procedures and purpose of the study. The preoperative data obtained from each subject included demographics (age, sex), indications for extraction, type of impaction, location of third molar (left or right), and the degree of impaction.

All subjects were evaluated preoperatively and postoperatively for facial swelling, mouth opening ability, pain, and quality of life, by the same surgeon, using the same method. Postoperative evaluation was done without reference to subjects' group allocation. All the impacted mandibular third

Fig. 1 Application of ice pack over the masseteric region

molars were evaluated using standard periapical radiographs and classified according to Winter's classification and Pell and Gregory classifications. Other data about the tooth including the reasons for extraction and location of impacted tooth were documented. The length of the surgery, bone operating time, and the total operating time were also recorded.

Baseline pain evaluation

Preoperative pain was assessed using 100 mm visual analog scale (VAS). The subjects were asked to mark on the line the point they feel represents their pain perception. Thereafter, the VAS score for each subject was determined by measuring in millimeters (mm) from the left extreme of the line to the point marked by the subject.

Preoperative facial width measurement

Facial width (facial edema) was measured preoperatively using the tape measuring technique as described by Gabka and Matsumara [19]. Three measurements were made in accordance with the following descriptions: The first measurement was from the tip of the tragus to the soft tissue pogonion ipsilaterally, while the second was from the tip of the tragus to the ipsilateral oral commissure, and the third was from the lateral canthus of the eye to the angle of the mandible ipsilaterally (Fig. 2). The measurements were taken thrice, and the average was recorded in centimeters (cm). All measurements were done by a single operator for all subjects.

Fig. 2 Facial width measurement

Preoperative mouth opening measurement

Preoperative mouth opening was obtained by use of the mono-block basic vernier caliper, as the maximum inter-incisal distance. This measurement was taken with the subject seated upright and the orbito-meatal line parallel to the floor. These measurements were repeated thrice, and the average was recorded in millimeters (mm). The incisal edges of the upper and lower central incisors were used as reference points, and where these were absent, the occlusal part of the edentulous ridges using the labial frenum as a guide for centrality was used (Fig. 3).

Preoperative (baseline) quality of life

All subjects completed a preoperative quality of life questionnaire (OHIP-14) before commencement of the surgical procedure. Scores were derived by summating responses to each question within a domain. Each item was scored as follows: not at all (score 1), a little (score 2), quite a lot (score 3), and very much (score 4). Scores 1 and 2 were considered together as little or not affected, while scores 3 and 4 were considered as moderately or severely affected. Possible total scores ranged from 14 (no problems) to 56 (experienced all the problems very much).

Subjects were categorized broadly into two groups (affected and not affected) as follows:

- Not affected—14–28
- Affected—29–56

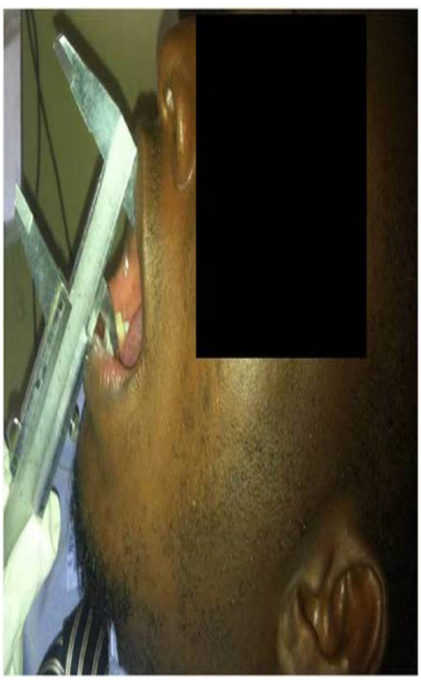

Fig. 3 Inter-incisal distance measurement

Operative procedures

All operations were carried out by the same surgeon under local anesthesia (2 % lignocaine hydrochloride with 1:80, 000 adrenaline). The inferior alveolar nerve and lingual nerve anesthesia were achieved with direct (conventional) technique, while long buccal nerve anesthesia was achieved with the standard buccal nerve block technique. Surgical extraction was carried out by raising a three-sided mucoperiosteal flap (Fig. 4). The buccal guttering technique was used to expose the tooth. Where necessary, sectioning of the tooth was done and delivery was done with coupland elevator. Tooth delivery was followed by copious irrigation of the surgical site with sterile water. Re-apposition of the flap was done with 3/0 black silk interrupted sutures.

Postoperative assessment

Subjects were evaluated postoperatively for pain, swelling, and maximal inter-incisal distance using the same method as described above. For pain measurement, each subject was given a postoperative pain assessment form (VAS) to be filled daily for 7 days. Subjects were instructed to fill it at 8:00 p.m. daily for 7 days. Postoperative facial width and mouth opening ability were recorded on the postoperative days 1, 3, and 7.

Fig. 4 Raised mucoperiosteal flap

Postoperative quality of life

All subjects were given QoL (OHIP-14) questionnaire for assessment of postoperative quality of life, on completion of the surgical procedure. They were instructed to fill the QoL (OHIP-14) questionnaire on postoperative days 1, 3, and 7. On the seventh postoperative day, it was filled after suture removal, while on postoperative day 1 (POD1) and POD3, they were instructed to fill it around 8:00 p.m. on both days. The responses for each of the individual questions in the domains under the OHIP-14 questionnaire were summated. All possible scores were classified into 2 as done for preoperative values.

Statistical analysis

Data was analyzed using the Statistical Package for Social Sciences (SPSS) for Windows (version 16.0, Chicago, IL, USA). The Student's *t* test was used in analysis of measures of pain, inter-incisal mouth opening, and facial swelling. Comparison of scores among the three groups was done using the analysis of variance (ANOVA). In calculating the sample size, the statistical power of the study was set at 80 % and the critical level of significance was set at $P < 0.05$. The differences between preoperative and postoperative oral health-related quality of life (OHIP-14) scores was assessed using the Student's *t* test, and the proportions of the "affected" and "not affected" subjects were compared among the three groups. The postoperative OHIP-14 scores of the three groups were compared using simple proportions and percentages.

Results

One hundred and thirty-nine subjects who satisfied the inclusion criteria and consented to participate were recruited for the study. However, 128 subjects participated in all phases of the study and were therefore included in the final analysis. There were 44 males and 84 females giving a male-to-female ratio of 1:1.9. The mean age (±SD) for all the subjects was 28.8 (7.96) years (range, 18–49 years). The mean age (±SD) of subjects was 28.8 (8.0) years and 28.7 (7.8) years for groups A and B, respectively. No statistically significant difference was observed ($P > 0.05$).

The most common type of impaction was mesio-angular (42.2 %), followed by distoangular (25 %), vertical (11.7 %), horizontal (17.2 %), and others (3.9 %). Recurrent pericoronitis (48.4 %) was the most common reason for surgical extraction, followed by caries and its sequelae (31.2 %), periodontal disease (10.9 %), and orthodontics (3 %). Other reasons for surgical extraction accounted for the remaining 6.4 %. There was no statistically significant difference in the

mean preoperative inter-incisal distance, pain, and facial width measurements for both groups (>0.05).

There was no statistically significant difference in preoperative pain values in comparison between both groups. Pain severity score was observed to be lower in group A than B throughout the postoperative evaluation period ($P < 0.05$). The highest mean pain score was recorded on POD1, and it gradually decreased over the immediate postoperative period in both groups. The highest difference in mean postoperative pain values was observed on POD1, while the lowest was observed on POD7. A reduction in the overall mean inter-incisal mouth opening measurements was observed when compared with the preoperative inter-incisal mouth opening measurements. This difference was statistically significant at all postoperative evaluation points. A comparison of the mean postoperative inter-incisal measurements between both groups showed higher values for subjects in group A than those in group B at all postoperative evaluation points. The difference was statistically significant only on POD1 ($P = 0.001$) and POD3 ($P = 0.001$). By POD7, the measurements in both groups approximated the preoperative values.

There was an overall increase in the mean facial width for both groups at all postoperative evaluation points. A comparison between the postoperative mean facial width and the preoperative facial width was statistically significant ($P < 0.05$). The mean postoperative facial width measurements in group A were lower than group B at all postoperative evaluation points. The observed differences were found to be statistically significant on POD1 ($P = 0.007$) and POD3 ($P = 0.008$). Though the value was still lower in group A by POD7, their difference was not statistically significant ($P = 0.306$).

Oral health-related quality of life (OHIP-14)

The overall preoperative mean (SD) OHIP-14 scores for groups A and B were 20.4 (±5.3) and 21.6 (±5.5), respectively ($P > 0.05$). The overall percentages of subjects that reported impairment of the various subscales preoperatively and postoperatively are shown in Table 1. Preoperatively, the "ability to chew" subscale was most frequently affected with 32.8 and 37.5 % of the subjects in group A and group B affected, respectively. The least frequently affected subscales were the "change in physical appearance," "difficulty in understanding you when you speak," and "unusual appearance" subscales (Table 1). However, there was no statistically significant difference between the two groups in all preoperative subscales. The overall proportions of subjects who reported impairment in various subscales postoperatively was found to be highest on POD1 (Table 1). These values decreased gradually over the second (POD3) and third (POD7) postoperative evaluation points. The ability to chew, "ability to swallow," "diet variation," "enjoyment of food," "mouth opening ability," and change in physical appearance subscales were most frequently impaired, while the least frequently impaired were the "difficulty in understanding you" and "voice change" subscales (Table 1).

A comparison of the overall mean postoperative OHIP-14 scores between the two groups revealed lower mean OHIP-14 score for subjects in group A than group B (Table 2). The difference between values in the two groups was found to be statistically significant at all postoperative evaluation points (POD1, POD3, and POD7) (Table 2).

A higher percentage of subjects reported impairment of their quality of life in group B than in group A at all postoperative evaluation points, although this was statistically significant on POD7 only (Table 3). More subjects in group A

Table 1 Preoperative and postoperative QoL subscales in all subjects ("percentage affected")

Domains	Percentage affected preoperative	Percentage affected POD1	Percentage affected POD3	Percentage affected POD7
Ability to chew	35.2	91.4	57.8	3.1
Ability to swallow	8.6	85.2	55.3	1.6
Diet change	21.1	85.9	68.0	6.2
Food enjoyment	21.1	84.4	55.5	2.3
Mouth opening	5.5	78.1	44.5	9.4
Food tasting ability	4.7	44.5	8.6	0.0
Voice change	2.3	37.5	8.6	0.8
Ability to speak	5.5	53.9	16.4	0.8
Difficulty in understanding you	0.8	21.9	3.1	0.0
Changed appearance	0.8	71.9	40.6	4.7
Unusual appearance	0.8	57.8	46.1	4.9
Problems sleeping	14.8	57.8	32.8	0.0
Sleep interruptions	17.2	52.3	31.2	4.7
Ability to perform duty	11.7	67.2	27.3	1.6

Table 2 Comparison of the mean OHIP-14 scores in the postoperative period between groups A and B

	Group A	Group B	*P* value
Mean OHIP-14 score on POD1	20.4	21.6	0.010
Mean OHIP-14 score on POD3	37.5	39.9	0.002
Mean OHIP-14 score on POD7	26.9	28.9	0.003

reported impairment of their ability to chew and ability to swallow on POD1 than in group B, although the difference was statistically significant only on POD3 for ability to chew ($P > 0.05$) (Table 4). However, by POD3, more subjects in group B reported impairment in their ability to chew than in group A. This difference was statistically significant ($P = 0.032$). A similar trend was observed on POD7 although the difference was not statistically significant ($P = 0.154$).

More subjects in group B reported impairment in their ability to swallow than in group A on POD3 and POD7 ($P = 0.374$). By POD7, only two subjects, both of which were in group B, reported impairment in their ability to swallow. The observed difference between the two groups on POD7 was not statistically significant ($P = 0.154$) (Table 4).

A higher proportion of subjects in group B reported impairment of their diet variation and enjoyment of food subscales at all postoperative evaluation points than in group A ($P > 0.05$) (Table 4). The proportion of subjects who reported impairment of their mouth opening ability was highest on POD1; this value reduced on POD3 until the lowest values were recorded on POD7. More subjects in group B reported impairment of mouth opening ability on POD1, POD3, and POD7 than in group A. The differences between the two groups were statistically significant at all postoperative evaluation points ($P < 0.05$) (Table 4).

Impairment of "food tasting ability" was most frequently reported on POD1 in both groups, although the frequency was less in group A. The values reduced on POD3, and by POD7, no subject reported impairment in this subscale. The difference in proportions of subjects who reported impairment in this subscale was statistically significant on POD3 only ($P = 0.027$) (Table 4). The highest proportions of subjects who reported voice alteration was observed on POD1; these values reduced by POD3 till POD7, when only one subject in group B and none in group A reported such. There were no significant differences between the two groups ($P > 0.05$) (Table 4).

Table 3 Comparison of the percentage of subjects affected in the postoperative period between groups A and B

Percentage of subjects affected	Group A	Group B	*P* value
POD1	93.9	96.8	0.403
POD3	65.6	79.8	0.074
POD7	18.8	59.4	0.001

Table 4 Percentage of subjects with impairment (moderate/severe) of eating ability and diet variation domain in both groups

	POD1 (%)	POD3 (%)	POD7 (%)
Ability to chew			
Group A	93.8	48.4	1.6
Group B	89.1	67.2	4.7
P value	0.344	0.032	0.310
Swallow			
Group A	85.9	51.6	0.0
Group B	84.4	59.4	3.1
P value	0.804	0.374	0.154
Change in diet			
Group A	84.4	60.9	3.1
Group B	87.5	75.0	9.4
P value	0.611	0.088	0.144
Enjoyment of food			
Group A	79.7	51.6	0.0
Group B	89.1	59.4	4.7
P value	0.144	0.374	0.080
Enjoyment of food			
Group A	70.7	51.6	0.0
Group B	85.9	59.4	4.7
P value	0.144	0.374	0.080
Ability to open			
Group A	70.3	20.3	0.0
Group B	85.9	68.8	18.8
P value	0.033	0.001	0.001
Taste			
Group A	40.6	3.1	0.0
Group B	48.4	14.1	0.0
P value	0.374	0.027	0.998

There was no significant difference in percentage of those affected between the two groups in domain "speech/speaking ability" except on POD1 for subscales "ability to speak" and "people understanding you when you talk" where those in group A were significantly more affected ($P = 0.01$) (Table 5). Table 6 shows the percentage of subjects with sleep impairment. The percentage of those affected declined throughout the evaluation and was more in group B than group A. However, a statistically significant more subjects in group B had problems falling asleep than in group A ($P = 0.008$).

A higher proportion of subjects in group B reported affectation of their physical appearance in the postoperative period than in group A (Table 7). The difference was statistically significant at all the postoperative evaluation points

Table 5 Percentage of subjects with impairment of speech/speaking ability in all groups

	POD1 (%)	POD3 (%)	POD7 (%)
Ability to speak			
Group A	43.8	15.6	0.0
Group B	64.1	17.2	1.6
P value	0.021	0.811	0.315
Change in voice			
Group A	34.4	4.7	0.0
Group B	40.6	12.5	1.6
P value	0.465	0.115	0.315
People understanding you when you talk			
Group A	12.5	4.7	0.0
Group B	31.2	1.6	0.0
P value	0.010	0.310	0.998

($P < 0.05$) (Table 7). Impairment of duty was also commonly seen in group B than in group A, and the difference was statistically significant at POD1 and POD3 (Table 7). The percentage of those who reported working and social isolations was high in both groups at POD1 and declined thereafter. While those who reported working isolation were significantly higher in group B than in group A at POD1, POD3, and POD7 (Table 8), the significance level was only reached at POD1 for social isolation.

Discussion

According to Knight and Londeree [20], ice pack therapy can reduce pain, cell metabolism, and muscle spasm. Furthermore, it may lessen the intensity of soft tissue inflammatory response to trauma. This, in turn, is believed to help reduce the adverse effects of third molar surgery on patients' quality of life [21]. The OHIP-14 was used to evaluate quality of life perception by patients. The OHIP-14 is a 14-item questionnaire designed to patients' subjective perception of functional impairment, discomfort, and disability attributed to oral conditions.

In this study, subjects reported deterioration in their quality of life in the immediate postoperative period when compared with their preoperative status. The overall mean OHIP-14 scores for all subjects was highest on POD1 and lowest on POD7; this finding is similar to reports from the studies of Laureano-Filho et al. and Tiwana et al [8, 22]. Both the mean OHIP-14 scores as well as the percentage of subjects whose reported quality of life score was defined as affected in group A were lower than those in group B at all postoperative evaluation points. This is in consonance with reports of the study Laureano-Filho et al. but at variance with that of Forsgren et al. [8, 23].

Forsgren et al. [23] in a randomized controlled trial of two groups with or without ice pack application found no significant differences in swelling, trismus, temperature, or postoperative pain which are predictors of postoperative quality of

Table 6 Percentage of subjects with sleep impairment

	POD1 (%)	POD3 (%)	POD7 (%)
Problems falling asleep			
Group A	48.4	29.7	0.0
Group B	45.2	31.3	1.6
P value	0.032	0.451	0.997
Experienced sleep interruptions			
Group A	40.6	29.7	3.1
Group B	64.1	32.8	6.2
P value	0.008	0.703	0.403

Table 7 Percentage of subjects with impairment of appearance and duty

	POD1 (%)	POD3 (%)	POD7 (%)
Change in appearance			
Group A	57.8	35.9	0.0
Group B	85.9	56.2	9.4
P value	0.001	0.001	0.012
Unusual appearance			
Group A	34.4	35.9	0.0
Group B	81.2	56.2	9.4
P value	0.001	0.021	0.012
Impairment of duty			
Group A	59.4	17.2	0.0
Group B	75.0	37.5	3.1
P value	0.060	0.010	0.154

Table 8 Percentage of subjects with work and social isolation

	POD1 (%)	POD3 (%)	POD7 (%)
Working isolation			
Group A	54.7	18.8	1.6
Group B	71.9	37.5	4.7
P value	0.044	0.018	0.080
Social isolation			
Group A	71.9	59.4	4.7
Group B	89.1	75.0	15.6
P value	0.014	0.526	0.138

life experience. This observation may have been due to the ice pack therapy regime employed by them. MacAuley et al. after performing a critical literature review concluded that repeated application at 10-min interval was most effective [24]. A similar observation was made by Rana et al. [25] who demonstrated that continuous cooling with the hilotherapy devices reduces postoperative swelling, pain, and trismus after third molar surgery compared to conventional cooling with cold packs. It should also be noted that since quality of life measurement in this study was subjective, patients may have responded positively to the placebo effect of having ice pack therapy which they consider as some kind of added intervention.

The statistically significant lower proportion of subjects who reported impairment of their ability to chew and to swallow in group A when compared with subjects in group B on POD3 may have been due to reduced pain experience by the subjects in group A. This may have been due to the use of cryotherapy which reduces peripheral nerve conduction as well as causes vasoconstriction [25]. The relatively worse impairment in the ability to chew and ability to swallow of subjects in group B may have been due to the unmitigated ongoing inflammation within the muscles of mastication which results in pain and trismus, making masticatory and swallowing movements difficult.

Although a lower percentage of subjects who received ice pack therapy reported an impairment of their enjoyment of food and change in their diet, this was not statistically significant. This finding suggests that the use of ice pack therapy does not improve these subscales significantly. On the other hand, this observation may be due to the fact that all subjects were given postoperative instructions and advice, which include dietary instructions.

The observed lower reportage of impairment of taste sensation by subjects in group A may have been a result of reduction in postoperative edema. Postoperative edema has been implicated in impairment of ability to taste because of increased pressure on the nerve fibers of the chorda tympani which lie lateral to the lingual nerve [6].

Impairment of speaking ability was observed in both groups postoperatively especially on POD1. Notably, by the seventh postoperative day, only one subject in group B reported impairment in speaking ability. Impairment of ability to speak may have been due to postoperative edema extending to the soft palate. Postoperative impairment of speaking ability was also reported by some researchers suggest that surgical third molar extractions should have little or no effect on ability to speak because the early phase of sound production is in the respiratory tract; while, changes in the position of the mouth creates a wave of resonance, which results in creation of various tones [26].

Notably, there was a reduction in the mouth opening ability of all subjects regardless of their group in the immediate postoperative period in comparison to the preoperative values. This is in agreement with studies by Tiwana et al., White et al., and Garcia et al. [22, 27, 28]. The mouth opening ability of subjects was better in group A at all postoperative evaluation points. This observation may be attributable to the anti-inflammatory effect of cryotherapy. Ice pack therapy has been argued to have substantial effect only on the superficial tissues; hence, the depth of targeted tissue is an important factor in determining its effectiveness [13].

Enwemeka et al. [15] in a study on the effect of cryotherapy on muscle found significant decrease falls in temperature of the skin and tissues up to 1 cm deep after 8 min of cold pack application. It was reported that significant cooling effect did not occur beyond 2-cm tissue depth during the cooling. However, the deeper tissues lost heat simultaneously as the superficial tissues warmed up, to the extent that 40 min after treatment, the deeper levels were cooler than the cutaneous and the deeper tissues up to 1.0-cm level [15]. A study by Possoff to determine the average thickness of the human cheek reported a mean thickness of 15 mm and a range of 10 to 19 mm [13]. This suggests that externally applied cryotherapy to the cheek may be effective enough to have reduced the severity of inflammation within the soft tissues, including the masetter. However, it may be argued that it would have less effect on the pterygoid muscles which are located deeper.

The observed lower pain severity perception among the subjects who received cryotherapy may have been due to the direct effect of cryotherapy on nerve conduction and inflammation. Cryotherapy increases the threshold for pain fibers and reduces nerve conduction velocity [13].

Subjects on cryotherapy generally reported lesser postoperative pain, lesser postoperative swelling, and lesser limitation of mouth opening, thereby leading to a better quality of life after third molar surgery when compared with subjects who did not apply cryotherapy.

Conclusions

Quality of life after third molar surgery was significantly better in subjects who had cryotherapy after third molar than those who did not have cryotherapy. Cryotherapy is a viable alternative or adjunct to other established modes of improving the quality of life of patients following surgical extraction of third molars. It is relatively safe as none of our subjects reported any adverse effect, cheap, easily available, and can be self-administered.

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