Research article

Patients' perception of gustatory changes after lower molar extractions

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ABSTRACT

Introduction and Aim: Gustatory changes in the form of loss of taste or alteration of taste or lingual paresthesia are often encountered post-extraction of molar teeth. The aim of this study was to assess patients' perception of gustatory changes/taste alterations following lower molar extractions in female patients attending the OPD (dentistry-clinics) at College of Dentistry, King Khalid University, Abha, Saudi Arabia.

Materials and Methods: Thirty consecutive new female adult patients indicated for extraction due to grossly decayed mandibular molars between the age of 19-45 were included in the study. These patients were evaluated using a self-administered interview to assess the lingual tactile and gustatory function impairments immediately after surgical procedures/extraction involving the lower molar region. They were re-evaluated seven days and one month after the surgical procedure. ANOVA for repeated measures was used to assess the statistical difference between patient responses at baseline (before the procedure), seven days, and one month after the surgical procedure. Tukey HSD post hoc multiple comparisons were made to find the group that is significantly different from others.

Results: There were no statistically significant differences between the responses at baseline, seven days, and one month after the surgical procedure concerning all the questions asked except Q2 and Q7 that dealt with the presence of tingling sensation on the tongue and ability to continue with their usual diet after the dental procedure, respectively.

Conclusion: There was only a transient change in a small proportion of patients in the lingual tactile and gustatory function after surgical extraction of mandibular molars, which was self-limiting and resolved by one month postoperatively.

Keywords: Extraction; molar; perception; surgery; taste.

INTRODUCTION

Extraction of molars is one of the most frequently performed procedures in oral and maxillofacial surgery. It could be due to many reasons such as dental caries, periodontal disease, fracture, or impacted dental arch position. Intraoperative and postoperative complications associated with this surgical procedure include pain, swelling, tooth-fracture, fracture of the tuberosity, injury to an adjacent tooth, immediate and delayed hemorrhage, gustatory impairment, and other sensory deficits due to peripheral nerve damage (1).

The special sensory innervation of the anterior two-thirds of the tongue is by chorda tympani (CN VII), and general sensory is by the lingual nerve (CN V_3), while the posterior third is by glossopharyngeal nerve (CN IX) and internal laryngeal nerve (CN X). Gustatory changes in the form of loss of taste (ageusia) or alteration of taste (dysgeusia), or lingual paresthesia are often due to the proximity of the chorda tympani nerve and lingual nerve to the surgical site. Retraction of the lingual flap, extraction of unerupted impacted molars, increasing age, type of impaction, surgical technique used, surgeons' experience, and sutures are all predisposing factors for nerve injury during tooth extraction. Pressure from local anesthetic solution after injection (2), intraoperative hemorrhage, or postoperative complications such as swelling, hemorrhage, and perineural inflammation may also cause damage to the lingual nerve (3). Symptoms such as burning sensation of the tongue and dysgeusia also depend on the severity of nerve injury (4, 5).

Authors have reported the prevalence of molar extractions in Saudi Arabia(6),India(7),United States of America, and other countries(8).Furthermore, the varying incidence of gustatory impairment following extraction of molar teeth under local anesthesia has been reported in the literature. Shafer *et al*., used a standard buccal approach in 17 young patients and found that only 2.9% of patients had a temporary deficit of taste disturbance and lingual nerve deficit up to 6 months after surgery(9).

Although Gulicher and Gerlach had a larger sample size of 687 patients, similar low (0.09%) taste deficits were reported when the same standard buccal approach was used(10). However, this study also reported a permanent deficit in 2.1% of patients when evaluated up to 6 months after surgery. Anand *et al*., who conducted a randomized controlled trial with 60 patients, reported a higher (38.3%) taste disturbance when evaluated up to 1 week after surgery(11). None of the patients in Akal *et al.*, and Ruiz *et al*., were found to have these problems after the surgical procedure (12, 13).Lingual sensory impairment is a serious complication with possible medico-legal implications and a common cause of litigation in dentistry (14).However, there are limited data about these issues from Saudi Arabia. Therefore, this study aimed to assess patients' perception of gustatory changes/taste alterations following lower molar extractions in young female patients attending the OPD of a teaching institute in the Asir region of Saudi Arabia.

MATERIALS AND METHODS

This study consisted of 30 consecutive new female adult patients indicated for extraction due to grossly decayed mandibular molars who were attending the OPD of Oral Surgery at College of Dentistry, King Khalid University, Abha, from October 2018 to June 2019. Female patients between the ages of 19-45 were included in the study using a convenience sampling method. The research protocol was approved by the Institutional Review Board (IRB) at the College of Dentistry at King Khalid University, Abha, Saudi Arabia (SRC/ETH/2017-18/070), in compliance with the Helsinki Declaration. All participants consented to participate in the study and signed the informed consent before enrolling in the study. Individuals with age above 45 years, systemic pathologies, diabetes, and endocrine pathologies, immune-suppression, cardiovascular pathologies, hypertension, nutritional and neurological alterations, patients with salivary gland pathology (hyposalivation, xerostomia, etc.), patients under pharmacologic treatment or antibiotic therapy, consumption of tobacco and/or alcohol; and having used any mouthwash one month prior and one month after the extraction were all excluded from the study.

The dental interns met with the participants and explained the study. Following this, the participants completed a self-administered interview with structured interview questions to assess the lingual tactile and gustatory function impairments after surgical procedures/extraction involving the lower molar region. The questionnaire included a neurosensory questionnaire(13)and a few other relevant additional questions to assess subjective symptoms of taste loss. The interview questions were in English and evaluated for face validity and content validity by two experts in the field. After this, it was translated and used in Arabic. Two independent Arabic professional translators in Arabic and English did the forward and backward translations of the questions.

The questionnaire was given to individuals on the day before the extraction and seven days after the surgical procedure. The same questionnaire was re-administered in the same study subjects one month after the surgical procedure. Table 1 shows the questionnaire used in the study.

Table 1: Questionnaire used for data collection

1	**Dental treatment procedure done**	**Date when the procedure performed**			
2	Do you feel any tingling sensation on the tongue?	Not at all	A little	Quite a lot	Very much
3	Have you experienced any loss of sensation on your tongue after the surgical procedure?	Not at all	A little	Quite a lot	Very much
4	Can you feel the temperature difference between food and beverages on each side of your tongue?	Not at all	A little	Quite a lot	Very much
5	Temperature difference if present is it on	Right side of tongue		Left side of tongue	
6	Did you notice any change in perception of taste?	Not at all	A little	Quite a lot	Very much
7	Did you continue with your usual diet after the dental procedure?	Not at all	A little	Quite a lot	Very much
8	Have you experienced any loss of taste?	Not at all	A little	Quite a lot	Very much
9	If you have a loss in taste sensation, when did it begin?	Immediately after the surgical procedure		Sometimes after the surgical procedure	
10	How would you describe the taste disturbance?	Complete loss of taste		Altered taste.	
11	How would you describe intensity of taste after your dental treatment procedure?	Same	Increased	Decreased	-
12	The loss in sense of taste is it-	Permanent		Temporary	
13	Does the change in taste cause any problems to you?	Always	When chewing	When eating	Others
14	Can you specify which location of your mouth you have loss of taste?	Tip of tongue	Lateral border of tongue	Posterior of tongue	Midline of tongue
15	Have you experienced any alteration of quality in sensing taste –	Sweet taste	Salty taste	Bitter taste	Sour taste

Data analysis

Descriptive statistics (frequency and percentages) were used to describe the patients' demographic and operative data. Responses to questions in the survey were summarized as frequency and percentages. ANOVA for repeated measures was used to assess the statistical difference between patient responses at baseline (before the procedure), seven days, and one month after the surgical procedure. Tukey HSD post hoc multiple comparisons were made to find the group that is significantly different from others.

RESULTS

One hundred potentially eligible participants were screened at the OPD of the Department of Oral Medicine and examined for eligibility. Among these, 47 confirmed eligibilities, but 17 refused to give consent. Hence 30 patients were included in the study. All 30 patients completed postoperative evaluations, and the data were analyzed.

Table 2: Demographic data of the participants

Participants	**Females**	**N (%)**
Age	19-27	20 (66.7)
	28-35	4 (13.3)
	36-45	6 (20.0)
	Total	30 (100)
Tooth extracted	Extraction of 36	5 (16.6)
	Extraction of 37	1 (3.3)
	Extraction of 38	5 (16.7)
	Extraction of 46	6 (20)
	Extraction of 47	4 (13.3)
	Extraction of 48	9 (30.0)
	Total	30 (100)

Table 3: Frequency tables based on the responses of questions 2-15

2-Do you feel any tingling sensation on the tongue?			
	Before treatment	**7 days after procedure**	**1 month after procedure**
	N (%)	**N (%)**	**N (%)**
Not at all	30 (100)	16 (53.3)	30 (100)
A little	0	11(36.7)	0
Quite a lot	0	3 (10)	0
Very much	0	0	0
3-Have you experienced any loss of sensation on your tongue after the surgical procedure?			
	Before treatment	7 days after procedure	1 month after procedure
		N (%)	N (%)
Not at all	-	28(93.3)	16 (53.3)
A little	-	2(6.7)	11(36.7)
Quite a lot	-	0	3(10)
Very much	-	0	0
4- Can you feel the temperature difference between food and beverages on each side of your tongue?			
	Before treatment	7 days after procedure	1 month after procedure
	N (%)	N (%)	N (%)
Not at all	0	0	0
A little	0	1(3.3)	0
Quite a lot	0	2(6.7)	2(6.7)
Very much	30 (100)	27(90)	28(93.3)
5-Temperature difference if present is it on			
	Before treatment	7 days after procedure	1 month after procedure
	N (%)	N (%)	N (%)
Right side of tongue	0	1(3.3)	0
Left side of tongue	0	0	0
Not applicable	30 (100)	29 (96.7)	30 (100)
6-Did you notice any change in perception of taste			
	Before treatment	7 days after procedure	1 month after procedure

	N (%)	N (%)	N (%)
Not at all	30 (100)	1(3.3)	30(100)
A little	0	4(13.3)	0
Quite a lot	0	6 (20.0)	0
Very much	0	19(63.3)	0
7-Did you continue with your usual diet during and after the dental procedure?			
	Before treatment	7 days after procedure	1 month after procedure
	N (%)	N (%)	N (%)
Not at all	0	1(3.3)	0
A little	0	4 (13.3)	0
Quite a lot	3(10)	6(20)	3(10)
Very much	27(90)	19(63.3)	27(90)
8-Have you experienced any loss of taste?			
	Before treatment	7 days after procedure	1 month after procedure
	N (%)	N (%)	N (%)
Not at all	30(100)	28(93.3)	30 (100)
A little	0	2(6.7)	0
Quite a lot	0	0	0
Very much	0	0	0
9-If you havea loss in taste sensation, when did it begin?			
	Before treatment	7 days after procedure	1 month after procedure
	N (%)	N (%)	N (%)
Immediately after the surgical procedure	0	2(6.7)	0
Sometimes after the surgical procedure	0	0	0
Not applicable	30(100)	28(93.3)	30(100)
10-How would you describe the taste disturbance?			
	Before treatment	7 days after procedure	1 month after procedure
	N (%)	N (%)	N (%)
Complete loss of taste	0	0	0
Altered taste.	0	2(6.7%)	0
Not applicable	30(100)	28(93.3%)	30(100)
11-How would you describethe intensity of taste after your dental treatment procedure?			
	Before treatment	7 days after procedure	1 month after procedure
	N (%)	N (%)	N (%)
Same	30(100)	28(93.3)	30(100)
Increased	0	0	0
Decreased	0	2(6.7)	0
Not applicable	0	0	0
12-The loss in sense of taste is it			
	Before treatment	7 days after procedure	1 month after procedure
	N (%)	N (%)	N (%)
Permanent	0	0	0
Temporary	0	2(6.7)	0
Not applicable	30 (100)	28(93.3)	30(100)
13- Does the change in taste cause any problems for you?			
	Before treatment	7 days after procedure	1 month after procedure
	N (%)	N (%)	N (%)
Always	0	1(3.3)	0
When chewing	0	0	0
When eating	0	0	0
Others	0	1(3.3)	0
Not applicable	30(100)	28(93.3)	30(100)

14-Can you specify which location of your mouth you have loss of taste?			
	Before treatment	7 days after procedure	1 month after procedure
	N (%)	N (%)	N (%)
Tip of tongue	0	0	0
Lateral border of tongue	0	0	0
Posterior of tongue	0	0	0
Midline of tongue	0	1(3.3)	0
Not applicable	30 (100)	29(96.7)	30(100)
15-Have you experienced any alteration of quality in sensing taste			
	Before treatment	7 days after procedure	1 month after procedure
	N (%)	N (%)	N (%)
Sweet taste	0	0	0
Salty taste; Bitter taste	0	1(3.3)	0
Sour taste	0	0	0
Not applicable	30 (100)	29(96.7)	30(100)

Q1- Basic characteristics of the patients

Thirty female patients between the age of 19-45 were included in the study (Table 2). They belonged to the 19-27 (n=20, 66.7%); 28-35 (n=4, 13.3%) and 36-44 (n=6, 20%) age group. They underwent extraction of tooth # 36 (n=5, 16.6%); 37 (n=1, 3.3); 38 (n=5, 16.7%); 46 (n=6, 20%); 47 (n=4, 13.3%) and 48 (n=9, 30%). These patients were evaluated forlingual tactile and gustatory function impairments before, during, and after the surgical procedure (Table 3).

Q2- Do you feel any tingling sensation on the tongue?

None of the participants felt any tingling sensation on the tongue preoperatively (n=30, 100%). Seven days after the procedure, 53.3% (n=16) did not feel any tingling sensation on the tongue, while 36.7% (n=11) felt a little' and 10% (n=3) felt 'quite a lot' of a tingling sensation on the tongue. However, the results returned to baseline values one month after the procedure, where none of the participants felt any tingling sensation on the tongue (n=30, 100%).

Q3- Have you experienced any loss of sensation on your tongue after the surgical procedure?

Seven days after the procedure, 93.3% (n=28) of participants did not experience any loss of sensation on their tongue after the surgical procedure, while 6.7% (n=2) experienced 'a little' loss of sensation. However, when evaluated one month after the procedure, you experienced any loss of sensation on your tongue (n=30, 100%).

Q4- Can you feel the temperature difference of food and beverages on each side of the tongue?

Pre-operatively, all the participants' very much' felt the temperature difference between food and beverages on each side of the tongue (n=30, 100%). Seven days after the procedure, the majority of the participants' very much' felt the temperature difference of food and beverages on each side of the tongue (n=27, 90%), while 6.7% (n=2) felt 'quite a lot' and 3.3% (n=1) felt a little' temperature difference of food and beverages on each side of tongue. At the end of one month, 93.3% (n=28) of patients reported that they 'very much' felt the temperature difference of food and beverages on each side of the tongue, while 6.7% (n=2) reported they felt 'quite a lot' of this difference on each side of the tongue.

Q5- Side of the tongue where temperature difference was perceived

Pre-operatively, all the participants felt the temperature equally on both sides while, seven days after the procedure, only 1 (3.3%) patient reported to have perceived temperature difference on the right side of the tongue. One month after the procedure, the results returned to the post-op condition, where all the participants felt the temperature equally on both sides.

Q6- Did you notice any change in perception of taste?

Pre-operatively, none of the participants felt any change in taste perception (n=30, 100%). 7 days after the procedure only 3.3% (n=1) did not feel any change in perception of taste while 13.3% (n=4) felt a little', 20.0% (n=6) felt 'quite a lot' and 63.3% (n=19) felt 'very much' change in perception of taste. However, the results returned to baseline values one month after the procedure, where none of the participants felt any change in perception of taste (n=30, 100%).

Q7- Did you continue with your usual diet during and after the dental procedure?

Pre-operatively, 90% (n=27) of the participants reported having a usual diet, while 10% (n=30) reported 'quite a lot' to this question. Seven days after the procedure, 3.3% (n=1) did 'not at all' continue the usual diet, while 13.3% (n=4) reported 'a little' and 20% (n=6) reported 'quite a lot' when asked if they could continue with their routine diet. However, the majority (63.3%, n= 19) of the participants' very much' continued their usual diet. One month after the

procedure, 90% (n=27) of the participants reported having a usual diet, while 10% (n=30) reported 'quite a lot,' which is the same as the preoperative baseline value.

Q8- Have you experienced any loss of taste?

Pre-operatively and one month after the procedure, none of the participants experienced any loss of taste. Seven days after the procedure, 93.3% (n=28) did 'not at all' experience any loss of taste, 6.7% (n=2) reported 'a little' loss of taste.

Q9- If you have a loss in taste sensation, when did it begin?

Among the 6.7 % (n=2) who reported a loss in taste sensation, it was noticed immediately after the surgical procedure, while 93.3% (n=28) did 'not at all' experience any loss of taste at any point of time during evaluation.

Q10- How would you describe the taste disturbance?

Seven days after the procedure, all these 6.7 % (n=2) patients who reported a loss in taste sensation described it as 'altered taste' whereas none of the participants reported 'complete loss of taste.' However, when evaluated after one month, none of the participants complained of any taste disturbance.

Q11- How would you describe the intensity of taste after your dental treatment procedure?

Seven days after the procedure, 93.3% (n=28) found the intensity of taste after the surgical procedure to be 'same' as before, while 6.7% (n=2) found that the intensity of taste 'decreased.'

Q 12- Was the loss in sense of taste permanent or temporary?

There was a temporary loss of taste reported in 6.7% (n=2) patients seven days after the procedure, whereas none reported any loss of taste when evaluated at the end of one month.

Q13- Does the change in taste cause any problems to you?

Out of the two patients who experienced the loss of taste seven days after the procedure, one patient (3.3%) reported that the change in taste 'always' caused problems while the other reported that this change in taste caused her problem 'other' while chewing or eating.

Q14- Can you specify which location of your mouth you have a loss of taste?

Only 1 (3.3%) specified the location of taste loss, and that was related to the region of the midline of the tongue. This was reported during the evaluation seven days after the procedure.

Q15- Have you experienced any alteration of quality in sensing taste?

Only one patient (3.3%) specified that she experienced alteration in 'salty and bitter tastes,' which was reported during the evaluation seven days after the procedure.

Table 4: ANOVA for comparative analysis of patients' perception on various re-evaluation periods

		Sum of Squares	**df**	**Mean Square**	**F**	**P-value**
Q2	Between Groups	6.151	2	3.076	18.408	0.000**
	Within Groups	13.367	80	.167		
	Total	19.518	82			
Q3	Between Groups	.089	2	.044	1.036	0.359
	Within Groups	3.733	87	.043		
	Total	3.822	89			
Q4	Between Groups	.089	2	.044	.420	0.658
	Within Groups	9.200	87	.106		
	Total	9.289	89			
Q6	Between Groups	.200	2	.100	1.851	0.163
	Within Groups	4.700	87	.054		
	Total	4.900	89			
Q7	Between Groups	4.356	2	2.178	7.078	0.001**
	Within Groups	26.767	87	.308		
	Total	31.122	89			
Q8	Between Groups	.089	2	.044	2.071	0.132
	Within Groups	1.867	87	.021		
	Total	1.956	89			
Q9	Between Groups	.356	2	.178	2.071	0.132
	Within Groups	7.467	87	.086		
	Total	7.822	89			
Q10	Between Groups	.089	2	.044	2.071	0.132
	Within Groups	1.867	87	.021		
	Total	1.956	89			

Q11	Between Groups	.356	2	.178	2.071	0.132
	Within Groups	7.467	87	.086		
	Total	7.822	89			
Q12	Between Groups	.089	2	.044	2.071	0.132
	Within Groups	1.867	87	.021		
	Total	1.956	89			
Q13	Between Groups	.556	2	.278	1.495	0.230
	Within Groups	16.167	87	.186		
	Total	16.722	89			
Q14	Between Groups	.022	2	.011	1.000	0.372
	Within Groups	.967	87	.011		
	Total	.989	89			
Q15	Between Groups	.089	2	.044	1.000	0.372
	Within Groups	3.867	87	.044		
	Total	3.956	89			

Note: **p value <0.001

Table 5: Post hoc Tukey HSD test analysis for comparative analysis of patients' perception on various re-evaluation period

Q2-Do you feel any tingling sensation on the tongue?				
	Durations	**Mean Difference**	**Std. Error**	**P-value**
Before treatment	7 days after treatment	-.56667-*	.10554	0.000**
	1 month after treatment	0.00000	.11329	1.000
7 days after treatment	Before treatment	.56667*	.10554	0.000**
	1 month after treatment	.56667*	.11329	0.000**
1 month after treatment	Before treatment	0.00000	.11329	1.000
	7 days after treatment	-.56667-*	.11329	0.000**
Q7-Did you continue with your usual diet after the dental procedure?				
Before treatment	7 days after treatment	.46667*	.14322	0.005**
	1 month after treatment	.00000	.14322	1.000
7 days after treatment	Before treatment	-.46667-*	.14322	0.005**
	1 month after treatment	-.46667-*	.14322	0.005**
1 month after treatment	Before treatment	.00000	.14322	1.000
	7 days after treatment	.46667*	.14322	0.005**

Note: **p value <0.001

DISCUSSION

This study evaluated the short-term changes in patients' perception of lingual tactile and gustatory function impairments after surgical extraction of mandibular molars using a self-administered questionnaire. The majority of the participants were between the age of 19-27 (n=20, 66.7%) and underwent extraction of the tooth due to gross caries, which could not be restored. None of the participants felt any tingling sensation on the tongue preoperatively, and one month after the extraction. Nearly half of the participants experienced varying grades of a tingling sensation on the tongue seven days after the procedure that corresponded to the suture removal. While all patients were given the same post-operative instructions, their compliance could have been different. This could be one reason for the tingling sensation on the tongue in 46.7% of participants. The compliance was not evaluated as it was not within the scope of the study. The occurrence of food impaction and periodontal health around the surgical wound could be attributed to this transient phenomenon (15).

The current study shows that the lower third molar extraction under local anesthesia may be associated with mild lingual sensibility impairment. In a study by Ruiz *et al.*, that evaluates patients' neurosensory perception after lower third molar extractions, slight taste alteration was perceived by patients one week after the surgical procedure, but they fully recovered one month after the extraction (13). This is in line with our study, where the partial loss of sensation on the tongue was experienced by a small proportion of participants (n=2; 6.7%) when evaluated a week after the surgical procedure but fully recovered after one month.

The loss of taste detected in few patients detected one week after the procedure could be explained in two ways. Either the partial loss of sensation started immediately after extraction or had a delayed onset. Lower third molars' extractions are the most common surgical procedure that causes lingual nerve damage (16), resulting in neurosensory deficits such as paresthesia and/or dysgeusia, hypogeusia, or ageusia. This is significant as such patients develop problematic issues like tongue biting, burning sensation, and thermal burns from hot food and drinks. Al-Samman *et al*., report that such situations are often encountered in patients with high difficulty scores (17). Loss of sensation on the affected side of

the tongue has been reported by other researchers, too(1).The highly varying position of LN is one of the main reasons (18) for nerve damage during various steps of the position such as incision, flap elevation, tooth extraction, and placing the suturing).Again, it could be due to simple anesthetic injections or due to the surgical procedure per se. Doh *et al*., report delayed paresthesia/neuropraxia of inferior alveolar nerve in a 53-year old woman, which resolved six weeks after the procedure following inflammatory drugs and steroids (19).

The tongue being a very sensitive organ, lingual paresthesia and dysgeusia are caused by a minute disturbance to the lingual nerve (1). Following injury, the nerve has a higher chance of spontaneous reinnervation and recovery inside the inferior alveolar canal. Only a small segment of the participants did not recover fully from the partial loss sensation regarding temperature, even at the end of one month. Nevertheless, Leung *et al*., report 'complete recovery' after external neurolysis of the injured nerve in fewer than 30% of patients achieved (20). In a study by Lata *et al*., a standard incision was made in all cases, and the only buccal flap was raised to minimize the risk of lingual nerve injury (5).

The results of the study showed that lingual nerve paresthesia occurred irrespective of reflection of the lingual flap and could be due to anatomical variations of the lingual nerve. The lingual nerve's anatomical course is such that the gustatory fibers are close to the third molar, near the mandibular lingual cortical plate, making this area especially susceptible to surgical trauma. Some gustatory fibers arising from the tongue also reach the brain stem through the mandibular branch of the trigeminal nerve (21). The presence of this alternative pathway may explain the reported cases of unilateral loss of taste after sectioning the root of the trigeminal nerve. Prolonged lingual nerve damage following inferior alveolar nerve anesthesia and wisdom tooth extraction are the interventions most likely to produce taste disorders (22).

There are varying data regarding gustatory deficits following lower molar extractions. While Shafer *et al*. and Gulicher and Gerlach, report a low incidence of taste disturbance (9, 10) and lingual nerve deficit (1.2% &2.9%, respectively), Anand *et al*., reported a higher occurrence (38.3%) of taste disturbance following third molar extractions (11). Akal *et al*., and Ruiz *et al*., in their prospective studies using the standard buccal approach (12, 13) did not report any gustatory or lingual nerve deficit up to 6 months. Although quality of life was not measured directly in the present study, the overall results show that only a small fraction of patients were affected by taste impairment following the lower molars extraction. Similar studies mention the deterioration of quality of life after molar extraction due to tissue damage and rarely lingual nerve injury (23). Although many studies report the status of patients' quality of life during the postoperative phase after molar extractions (22), there are relatively fewer studies specific to impairment of the tongue.

Furthermore, in evaluating a case of gustatory changes following dental procedures, it is necessary to exclude other causes of taste impairment such as head injury, endocrine, metabolic, autoimmune, and salivary gland disorders; and medications such as acetylsalicylic acid, captopril, metronidazole, biguanides, levodopa, carbamazepine, and methotrexate; cancer treatment (radiation or chemotherapy), infections like viral, bacterial, and fungal. Malaty and Malaty state that over 95% of perceived taste disorders reported by patients are caused by olfactory (sense of smell) loss rather than gustatory (taste) loss (24).Therefore, it is also essential to assess the olfactory function of patients who complain of loss of taste sensations following extractions. Feeney *et al*., has found that there was an association between taste perception and BMI in women, phenotype, genotype, and variation of the TAS2R38 gene, which points towards a multi-factorial etiology of taste disturbances especially in women (25).

Strengths and limitations of this study

This is the first of its kind that evaluates patients' perception of gustatory changes/taste alterations following lower molar extractions in young female patients attending the OPD of a teaching institute in College of Dentistry, King Khalid University, Abha, Saudi Arabia. This information is needed to improve patient care. However, this study has few limitations, such as a small sample size, inclusion of only female patients. This is a pilot study, and the questionnaire used in this needs to be validated in a larger group of patients, including broader age groups and different medical conditions. Another limitation is the subjective nature of the study. However, this is because it is based on patients' perception and perception varies from person to person. Only a one-month postoperative evaluation was possible because many patients refuse to come back after one month, which corresponds to almost complete extraction of wound healing in most of the patients. Since the College of Dentistry, King Khalid University is the only tertiary-care hospital in the Southern region of Saudi Arabia, the patients included in the study can be considered representative of this region, and hence the results can be generalized.

Clinical implications and future perspective

To reduce such neurological complications, it is necessary to have a preoperative radiological examination to assess various risk factors and select appropriate surgical techniques. The use of cone-beam computer tomography offers better

differentiation in understanding the true relationship between the inferior alveolar canal and third molar in the overlap of root tips and inferior alveolar canal or other discrepancies as a diversion, narrowing, or interruption of the canal. A proper understanding of patients' medical conditions and a detailed case history is needed to make a correct evaluation to rule out other dysgeusia causes and protect oneself from medico-legal litigations.

Table4 shows no statistically significant difference between the responses at baseline, seven days, and one month after the surgical procedure concerning all the questions asked except Q2 and Q7. ANOVA showed a statistical significance difference between baseline (before treatment), seven days (suture removal), and one month after the surgical procedure concerning question 2 -Do you feel any tingling sensation on the tongue? (ANOVA for repeated measures: $F=18.408$; $df=2$; $p< 0.05$). Similarly, ANOVA showed a statistical significance difference between baseline (before treatment), seven days (suture removal), and one month after the surgical procedure concerning question 7- Did you continue with your usual diet after the dental procedure? (ANOVA for repeated measures: $F=7.078$; $df=2$; $p< 0.05$). Tukey's HSD post hoc test results are shown in Table 5.

CONCLUSION

Table 4 shows no statistically significant difference between the responses at baseline, seven days, and one month after the surgical procedure concerning all the questions asked except Q2 and Q7. ANOVA showed a statistical significance difference between baseline (before treatment), seven days (suture removal), and one month after the surgical procedure concerning question 2 -Do you feel any tingling sensation on the tongue? (ANOVA for repeated measures: $F=18.408$; $df=2$; $p< 0.05$). Similarly, ANOVA showed a statistical significance difference between baseline (before treatment), seven days (suture removal), and one month after the surgical procedure concerning question 7- Did you continue with your usual diet after the dental procedure? (ANOVA for repeated measures: $F=7.078$; $df=2$; $p< 0.05$). Tukey's HSD post hoc test results are shown in Table 5.

Within the study's limitations, it can be concluded that there was a transient change in a small proportion of patients in the lingual tactile and gustatory function after surgical extraction of mandibular molars, which was self-limiting and resolved by one month postoperatively.

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CONFLICT OF INTEREST

The authors have stated explicitly that there are no conflicts of interest in connection with this article.

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