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Research Article

The Effect of Lateral Osteotomy in Rhinoplasty on Hearing of Patients Undergoing Rhinoplasty

Ali Goljanian Tabrizi[1] and Reza Karimi[2*]

[1]Associate Professor, Otolaryngologist and Head and Neck Surgeon,
Taleghani Hospital, ShahidBeheshti University of Medical Sciences, Tehran, Iran.
[2]Otolaryngologist and Head and Neck Surgeon,
Taleghani Hospital, ShahidBeheshti University of Medical sciences, Tehran, Iran.
*Corresponding author: Dr. Reza Karimi, Email:Dr.rezakarimi@gmail.com

ABSTRACT

Introduction: In rhinoplasty, osteotomy is considered as one of the main components of the operation and the intensity of the impact must be to an extend so it could cause bone fracture.It seems that with the same mechanism, this process may lead to damage to the auditory cells andthe incidence of sensory-neural hearing loss. Therefore, in this study we decided to investigate the effect of lateral osteotomy in rhinoplasty on hearing of patients undergoing rhinoplasty

Materials and Methods: In this study, which was pre-post clinical trial type, sample subjects were selected from all age groups over 18 years of age, regardless of gender,who referred to ENT clinic of Taleghani Hospital for rhinoplasty. After the inclusion of patients in the study and completing the initial questionnaire, an audiometry testwas performed prior to the surgery, and patients underwent rhinoplastyaccording to the determined schedule.
Then, in 3 and 15 days after the operation, the DPOAE test was performed for patients to determine whether the person is suffering from acute transient hearing loss caused by operation. Data were analyzed using SPSS ver. 18 software.

Findings: The results of this study showed that the average SN ratiobefore surgery has reduced 3 and 15 days after surgery in patients undergoing rhinoplasty ($P < 0.001$). Also, the average DPOAE level before surgeryhad decreased 3 and 15 days after surgery in patients undergoing rhinoplasty ($P < 0.001$),although this was statistically significant, but this decrease is very low and clinically insignificant.

Conclusion:this study showed that inlateral osteotomy in rhinoplasty, thehearing level of patients does not decrease clinically compared to pre-surgery.

Keywords: Lateral osteotomy, Rhinoplasty, Hearing

INTRODUCTION:

Rhinoplasty is one of the most commonly used cosmetic surgeries in the country and every day, the number of people who want to do this surgery increases. During this type of surgery, performing osteotomy and the severity of the trauma caused by it can cause some degree of impairment in external auditory cells (Outer Hairy Cell), which can ultimately lead to impairment in the auditory system (1, 2). The exposure of the ear to the noise is a known factor in surgery that leads to hearing loss (3, 4, 5). The lateral osteotomy can be a potential source of high-frequency audio outputs that can lead to acoustic damages (6,7,8). Therefore, the produced noise is considered as the main cause of hearing loss in facial surgery (9-12),for example, with therapeutic methods during mastoidectomy, a healthy ear may be exposed to extreme levels of noises (13). It has been shown

that drilling in mastoidectomy may involve exposing the ear to noise levels of about 100 dB andthe cochlear to a level of 5 to 10 dB (14, 15). In this regard, noise levels and exposure time interval may be the major determinant factorsin the level of hearing loss(16).In a mastoidectomy, due to longer drilling time, a higher level of transient hearing loss caused by noise is expected.

Obviously, one of the basic rights of patients is to know the side effects of surgical procedures. Also, doctors should be aware of any possible complications in order to prevent themfrom occurring and avoid unnecessary surgeries.

In a survey on databases such as Cochran, Medline, Embase and etc., no study was found conducted on the effect of lateral osteotomy on hearing of patients undergoing rhinoplasty.

Dr Abolfazl Sadeghie Nejad conducted a study on evaluating the effects of orthognathic surgery on hearing levels of patients operated in the maxillofacial surgery department of Taleghani Hospital from the beginning of 2003 to the end of the first six months of 2004. They concluded in this study that performing orthognathic surgeries on the jaw leads to a degree of hearing loss, which in most cases was mild and transient and did not require special treatment (17).

Several studies have been conducted on evaluating the effect of acoustic traumadue to drilling in surgical procedures such as mastoidectomy and craniotomy. The results of some of these studies show thatacoustic trauma caused by mastoidectomy leads to damages to outer hair cells (OHC) and leads to incidence of hearing loss in the ear of the same side and in some cases, in the ear of opposite side.

In a study by Dr. Farzanegan et al. (2010) at Baqiyatallah University, which its results are published in the British Journal of Neurology,the effects of acoustic trauma,due to craniotomy during neurological and neurological surgery, on hearing of patientshave been investigated. In this study, the audiometry (SRT, PTA) was performed for 39 patientsbefore craniotomyand one week and one year after it.Hearing loss was not significant at low frequencies (0.25-2 KHZ), but at high frequencies (4-6KHZ) this level was statistically significant. They concluded that the level of sensory-neural hearing loss was higher in the elderly (1).

In a study published in 1992 in the journal Laryngoscope,40 patients undergoing mastoidectomy were evaluated for the incidence of sensory-neural hearing loss.In this cohort study, no significant hearing loss was found in these patients (18).

In another study (1991),drilling for Meniere's disease led to acoustic trauma and hearing loss in studied patients (19).

Another study (1989) was conducted on 24 patients undergoing tympanomastoidectomy. In these patients for whom temporal bone drilling for surgery was performed, 9 patients (37.5%) suffered from sensory-neural hearing loss at the high-frequencies. The hearing loss rate was very severe in 4 patients (16%) (20).

In a study conducted in 1985, the effect of mastoidectomy-induced acoustic trauma on the hearing of the opposite ear was examined. In this study, 62 patients were examined, which eventually it was determined that mastoidectomy in the involved ear does not lead to hearing loss in the opposite ear (21). However, in a similar study (1975), the researcher pointed out that the mastoidectomy-induced acoustic trauma, although it is 5-10 dB lesser in opposite ear, but it can lead to injury to the opposite ear (22).

Since, osteotomyin rhinoplasty is considered as one of the main components ofthe surgery, andthe intensity of the impact must be to an extend to cause bone fractures,it seems that with the same mechanism, this process may lead to damage to the auditory cells and the incidence of sensory-neural hearing loss. Therefore, in this study we decided to investigate the effect of lateral osteotomy in rhinoplasty on hearing of patients undergoing rhinoplasty.

MATERIALS AND METHODS:

In this study, which was pre-post clinical trial type, sample subjects were selected from all age groups over 18 years of age, regardless of gender,

who referred to ENT clinic of Taleghani Hospital for rhinoplasty.Given that patients may not complete all the stages of the study, the sample size N*was calculated as follow:

N*=Nd/(1-RO) 2

RO = *Exclusion coefficient which was considered as 10% or 1.0.*

Taking into account these coefficients, the final sample size obtained as 19.

Inclusion criteria for individuals to be included in sample population was people over the age of 18 years who have referred to the Taleghani Hospital for initial rhinoplasty and theiraudiometry test was normal, and lateral osteotomy has been performed from them during their operation.

On the other hand, people under the age of 18 or with some degrees of hearing loss or cases of revision rhinoplasty were excluded from the study.

At the beginning of the study,a moral consent was obtained from the patient by explaining the conditions. This study will be carried out in accordance with the guidelines of the GOOD Clinical Practice and Helsinki Accords and in compliance with University's research lawsfor obtaining written consent (from patients or their patients) and the protection of patients' rights.

After selecting patients and before including theminthe study, a questionnaire was filled out to record the patient's demographic data (age, sex, ...).The main outcome variable in this study was the auditory index of the patient after 15 days, which was measured by DPOAE method as follow:

1. After inclusion of the patient into the study and completing the questionnaire,auditometry was performed on patientsbefore the surgery, and patient underwent rhinoplasty according to the specified schedule.
2. Following this, 3 and 15 days after surgery, a DPOAE test was performed again for the patient to determine whether the person suffered fromhearing loss.

Finally, the results of DPOAE test, before surgery and 3 and 15 days after surgery were compared to determine whether osteotomy can cause hearing loss.Patients were examined at the beginning of the study and then 3 and 15 days after the surgery.

Measurement in this study was as before-after, and theresearcher was aware of the study hypothesis. Data were analyzed using SPSS ver. 18 software. The statistical test used in this study for analyzing the quantitative variables that were measured as before-after was paired t-test.

All statistical tests were carried out in two domains and by considering the significance level of 0.05.

FINDINGS:

In this study, 38 subjects with an average age of 26.8 ± 4.2 were studied.The demographic characteristics of the population studied are presented in Table 1.

Table 1. Demographic characteristics of the population studied

Number (percent)	Variable	
18(47/4)	18-24	age category
20(52/6)	19-35	
8(21/1)	Male	Sex
30(78/9)	Female	
38		Total

As shown in Table 2, the average SN ratio before surgery had a decreasing trend3 and 15 days after surgeryin patients undergoing rhinoplasty. By using Repeated measures test, it was determined that there is a significant difference between three measurements at different frequencies (1000.2000.4000.8000 Hz) (P <0.001).

Then, using the LSD Post Hoc test,it was determined that at frequencies of 4000, 2000, 1000, and 8000 Hz,the difference between the three measurements was due to the difference

between the average SNratio before the surgery and three days after it. Meanwhile, the results showed that there was no difference in results between the left and right ears,which means that the effect on both ears was the same.

Table 2. Comparison of average SN ratio before surgery, 3 and 15 days after surgery in patients undergoing rhinoplasty.

The result of the statistical test	Fifteen days after surgery Mean ± standard deviation	Three days after surgery Mean ± standard deviation	Before surgery Mean ± standard deviation	Time measurement Frequency
P=0/02 df=2 F=4/11	6/63±0/41	6/63±0/41	6/67±0/43	Frequency 1000 Hz
P<0/001 df=2 F=29/11	6/78±0/54	6/69±0/51	6/82±0/51	Frequency 2000 Hz
P<0/001 df=2 F=46/42	6/81±0/46	6/73±0/47	6/84±0/48	Frequency 4000 Hz
P<0/001 df=2 F=32/71	6/77±0/44	6/65±0/45	6/78±0/46	Frequency 8000 Hz

As shown in Table 3, the average DPOAE level before surgery had a decreasing trend 3 and 15 days after surgery in patients undergoing rhinoplasty. Using Repeated measures test, it was Then, using the LSD Post Hoc test, it was determined that difference between the three measurements at frequencies of 4000,2000,1000 and 8,000 Hz was due to the difference between the average DPOAE level before the surgery and 3 determined that there is a significant difference between the three measurements at different frequencies (1000.2000.4000.8000 Hz) (P <0.001).

days after it, as well as before the surgery and 15 days after it. The results also showed that there was no difference in results between the left and right ears,which means the effect on both ears was the same.

Table 3. Comparison of the average DPOAE level at various frequencies (1000.2000.4000.8000 Hz) before the surgery, three days and fifteen days after the surgery in patients undergoing rhinoplasty

The result of the statistical test	Fifteen days after surgery Mean ± standard deviation	Three days after surgery Mean ± standard deviation	Before surgery Mean ± standard deviation	Time measurement Frequency
P=0/03 df=2 F=9/13	16/96±1/22	16/91±1/31	17/03±1/32	Frequency 1000 Hz
P=0/006 df=2 F=5/42	17/13±1/11	17/07±1/09	17/15±1/13	Frequency 2000 Hz
P<0/001 df=2 F=19/03	17/50±0/85	17/43±0/85	17/54±0/87	Frequency 4000 Hz
P<0/001 df=2 F=34/13	17/24±0/88	17/09±0/89	17/32±0/91	Frequency 8000 Hz

CONCLUSION:

This study was conducted with aim to evaluate the effect of lateral osteotomy in rhinoplasty on hearing of patients undergoing rhinoplasty. In rhinoplasty, osteotomy is considered as one of the main components of the operation and the intensity of the impact must be to an extent to cause bone fracture. It seems that with the same mechanism, this process may lead to damage to the auditory cells and the incidence of sensory-neural hearing loss. Therefore, our goal in this study was to helpsurgeons in preventing this injury.The main result of this study was that the hearing level of patients after the surgery was not significantly different from pre-surgery, and this level was not significantly different between the two ears(P-value < 0.05). studiesby HICKEY (1991)(19) and Domenech (1989) (20)came to similar conclusions, although these two study were not conducted exactly on rhinoplasty. On the other hand, Urquhart et al. (1992), Man et al. (1985), and Kylen et al. (1976) achieved different results, and did not report hearing loss following surgical procedures.Our study also showed that lateral osteotomy in rhinoplasty potentially does not have a decreasing effect on hearing loss in patients.

But this study also had limitations.First, the sample size was small. Evaluating the hearing loss in the ear cannot be donein different subgroups, such as a different population of patients and a variety of surgeries. Second, this study was conducted for the first time on rhinoplasty,in which it contrasted with the results of some relatively similar studies, and it was consistent with others. Therefore, this study should be repeated at a wider level and in different populations, so that more powerful results can be presented and used. Overall, this study showed that in lateral osteotomy of rhinoplasty,hearing level of patients does not decreased compare to pre-surgery.

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