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Original Article

Assessment of Altered Sensation and Functional Effects in Post-Operative Bilateral Mandibular Sagittal Split Osteotomy Patients: a Follow-up Study

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Abstract

Background: Bilateral sagittal split osteotomy aims to improve and correct functional problems related with facial defects and aesthetics. But osteotomies are placed in closed vicinity with the inferior alveolar nerve hence an incidence of nerve paresthesia producing sensory and functional effects has been reported.
Objective: The purpose of this study was to report the incidence of nerve paresthesia (and problems they face due to altered sensation and function) immediately, on six months and one year follow up in patients undergoing the procedure of bilateral sagittal split osteotomy.
Study settings & duration: The study was conducted at Islamic International Dental College & Hospital, Islamabad over a period of five years starting from 2013 to 2017.
Methodology: The sample population consisted of 18 operated subjects who had undergone bilateral sagittal split osteotomies between the years 2013 and 2017 at the Department of Maxillofacial Surgery at Islamic International Dental Hospital Islamabad. Patients were called to hospital at three different intervals i-e 0 months, six months and 1 year after the surgery. They were asked to answer several questions regarding their perceived sensory changes after the operation by selecting a word from a standardized list describing altered sensation.
Results: Seventeen patients had changes in sensation immediately after the surgery. And all the seventeen patients had changes in sensation in lower lip and chin. Seven patients have hypoesthetic sensation, one patient had paresthetic and two patients had dysesthesic sensation one year after the surgery. no patient had pain due to altered sensation immediately, six months or one year after the surgery.
Conclusion: More than half of the operated subjects have some sort of paresthesia one year after the surgery. But only two patients had functional problem and one patient had speaking problem due to altered sensation.
Key words: Bilateral sagittal split osteotomy, paresthesia, inferior alveolar nerve.

Introduction

The aim of the orthognathic surgery and bilateral sagittal split osteotomy (BSSO) is to improve facial deformity along with aesthetics. This treatment not only treats the mandibular defect but it also has influence on patient's psychosocial aspects since personality and self-esteem are influenced by facial appearance.[1-3] The surgery also improves masticatory function and facial aesthetics. But there can also be post operative complications such as paresthesia due to nerve damage, infections, relapse, open bite, TMD and malunion or nonunion of bone fractures.[4]

One of the important drawback of surgery includes damage to inferior alveolar nerve (IAN) as the osteotomy in BSSO is performed in close vicinity of the inferior alveolar nerve.[5] So it is at particular risk of complete or partial transection, extension, compression, crushing, stretching, ischemia, pressure or edema from fixations screws after Bsso.[6]

Inferior alveolar nerve is the branch of third division of trigeminal nerve. It encodes the sensory information about chewing, speaking, facial

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Authors Contribution

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expressions and stimuli that come in contact with orofacial tissue. Partial or complete resection of the nerve during the surgery can result in loss of sensations after the orthognathic surgery which can lead to discomfort for patient. Damage can also result in deficits including numbness or unusual sensations in the lower lip, teeth, gingiva and chin. It can also result in transient or permanent paresthesia.[7] Persistent discomfort and pain during occlusion can occur. Quality of life of the patient is significantly disturbed due to these problems and this can lead to litigation and complaints by patient about their treatment.

Almost all the patient that go through the orthognathic surgery experience some form of neurosensory impairment and half of them may not recover orofacial sensory function completely.[8-10] Two types of materials including bioresorbable and titanium plates can be used for semi rigid fixation after BSSO. A survey was reported based on the complications produced by the different types of plates in orthognathic surgery. The complications rate was 18.3% when resorbale plates were used and 8.6% when titanium plates were used.[11] All the cases included in the current survey are treated and fixed with titanium plates.

The recovery and rehabilitation is important because another study was conducted on the importance of informed consent in orthognathic surgery. They concluded that patients who responded with no to the question regarding whether they would go through the same surgery again or not said so because of the complications and post-operative paresthesia.[12]

Different treatment modalities including non-pharmacological, pharmacological and surgical have been used in order to improve the altered sensations but there has been no systematic evidence on the effectivity of these therapies.[13,14] Physical and behavioral therapy can be brought in use in order to improve the patient's capability to understand the altered sensory response from injured sensory nerves and to change the patient's perception of function.[9]

Reported incidence of nerve injury has extreme variation which suggests that the effects of different variations have been reported scarcely.[15]

Methodology

A study was conducted over a period of five years starting from 2013 to 2017 and patients were called via phones to visit the clinic for follow-ups at 0-month, six-months and 12 months respectively.

The setting of the study was Islamic International Dental College & Hospital, Islamabad. All the patients who underwent mandibular bilateral sagittal split osteotomy during the five year period (2013-2017) were contacted. A performa was designed and validated by three independent researchers. Patient were called in the hospital and were asked to rate their paresthesia at the three pre-defined follow-up visit protocol; immediately after the surgery, 6-months and one-year after the surgery on scale of 1 to 10 (1 being worst to 10 being normal). Several questions regarding how they can describe the change and what problems do they face due to this altered sensation and function were asked and recorded in performa. Recall and subjective bias was reduced by keeping a patient's post operative files and record (Every patient who underwent orthognathic surgery had a series of follow ups by surgery and orthodontic department). Post operative files with all the records regarding the post operative complications, bite, altered sensation and functions with photographs and statements in patient's words for up to a year has been maintained as a department protocol.

In all the post operative visits, the patient's sensation and function were evaluated by asking them to just keep their face at rest and do not give any facial expression. A finger was used to help in location of each site (i-e lower lip, chin, cheeks), the patient was inquired whether he felt any altered sensation at that site which indicates spontaneous alteration. In case if altered sensation was existent, the patient was instructed to choose any word from a standardized list to define the altered sensation. Then the patient was asked to make facial expressions and the whole procedure was repeated to assess evoked alteration. The patients were asked to choose words from the list to describe their sensation either spontaneous or evoked immediately after the surgery, six months and one year after the surgery.

A simple loss in sensation (eg, numbness), or rather passive or benign alterations in sensation such as swollen, rubbery, warm, and wet were stated as hypoesthesia. Paresthesia was referred to active sensations that are not usually present, such as tickling, tingling, and pulling. Dysesthesia differed from paresthesia in the context that dysesthesia is assumed when discomfort or pain was implied and patient used words such as tender, sore and burning.

Last part of performa included the functional problems related to alterated sensation. The patients were asked if they have problems in detecting drooling and food particles on their chin, or if they have speaking problems. This was also assessed on the VAS score and scores were taken at three intervals which were immediately after the

surgery, six months and one year after the surgery. All the data given by the patient was recorded in the performa.

The data was analysed with the SPSS 21 and demonstrated in form of bar charts and tables.

Informed, verbal Consent was taken. Information was provided in a format that can be easily understood by patients. All the data acquired for research purpose was kept confidential to prevent disclosures of patient identity. Proper care and caution was taken in order to prevent the patient from any harm and adverse events.

Results

All the 18 patients who underwent single jaw bilateral sagittal split osteotomy without genioplasty or lefort 1 from 2013 to 2017 were involved in the study. Seventeen (94.4%) patients had changes in sensation immediately after the surgery and all the seventeen patients had changes in sensation in lower lip and chin. All the 17 (92.8%) patients used a word among numbness or swollen to describe their hypoesthetic sensation. whereas 10 (55.6%) patients had some sort of altered sensation one year after the surgery. After six months, eight (44.44%) patients had changes in sensation in lower lip and chin, five (27.7%) patients in only lower lip, three (16.6%) patients in chin and two (11.1%) patients had no change in sensation. One year after the surgery, four (22.2%) patients have changes in sensation in lower lip and chin, four (22.2%) in lower lip, two (11.1%) in chin and eight (44.44%) have no changes in sensation and have fully recovered after one year (Table).

Figure-1 shows problems including numbness, altered sensation, less sensitivity in lips and mouth and pain associated with altered sensation at three different times intervals (immediately after the surgery, at six months and at one year follow up after the surgery).

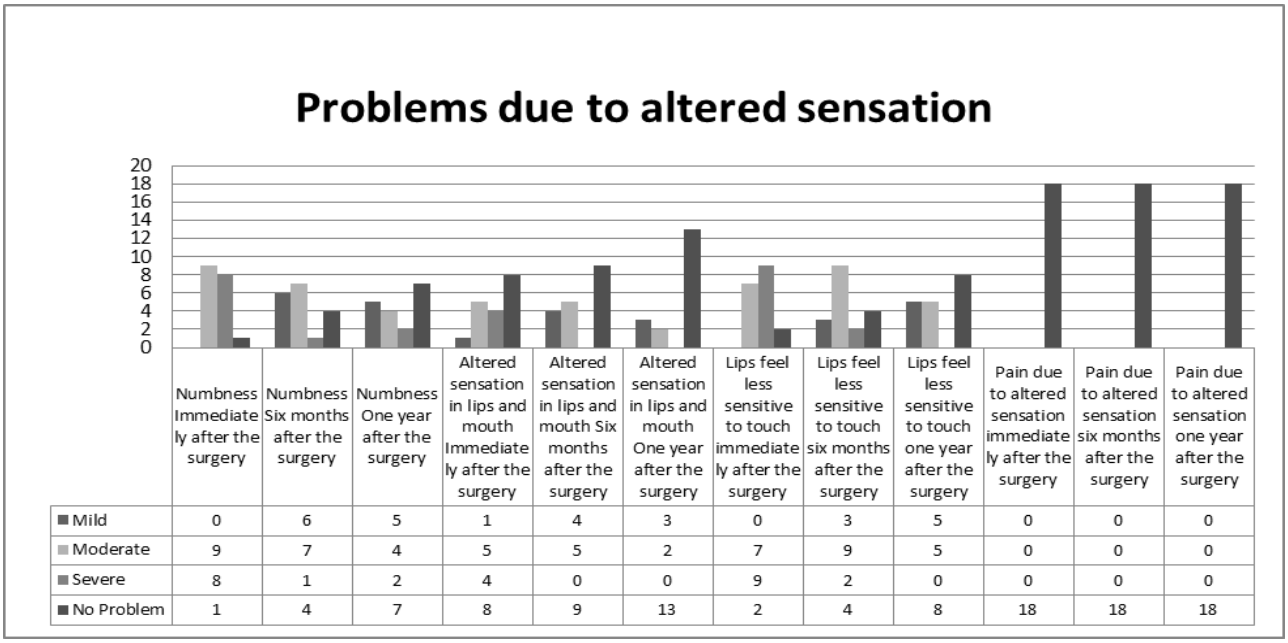
Nine (50%) patients had moderate numbness immediately after the surgery, seven (38.8%) patients had moderate numbness six month after the surgery and seven (38.8 %) patients had no change in sensation at one year follow up. Eight (44.4%) patients had no spontaneous altered sensation immediately after the surgery, nine (50%) at six months interval and 13 (72.2%) at one year follow up had no change in sensation. Nine (50%) patients has severe evoked less sensitivity in lips and chin immediately after the surgery, nine (50%) patients had moderate less sensitivity and eight (44.4%) patient had no sensitivity and fully recovered at one year follow up. No patients had pain due to altered sensation immediately, at six months or at one year follow up as shown in Figure-1.

Figure-2 shows functional problems including drooping of saliva or food particles at chin, inability to tell how a smile looks without looking in mirror and speaking problems due to altered sensation.

Eleven (61.1%) patients had severe problem immediately after the surgery, six (33.3%) had no problem at six months and nine (50%) had no problem at one year after the surgery. Nine (50%) patients immediately after the surgery, eleven (61.1%) at six months and sixteen (88.8%) at one year said that they can tell how their smile looks without looking at mirror. Eleven (61.1%) patients immediately after the surgery, three (16.6%) at six months interval and one (5.55%) at one year follow up had severe functional problems that they couldn't tell if they had food particles on their chin. Thirteen (72.2%) patients immediately after the surgery, fifteen (83.3%) at six months follow up and seventeen (94.4%) at one year follow up said that they don't have any speaking problem after the surgery as shown in Figure-2.

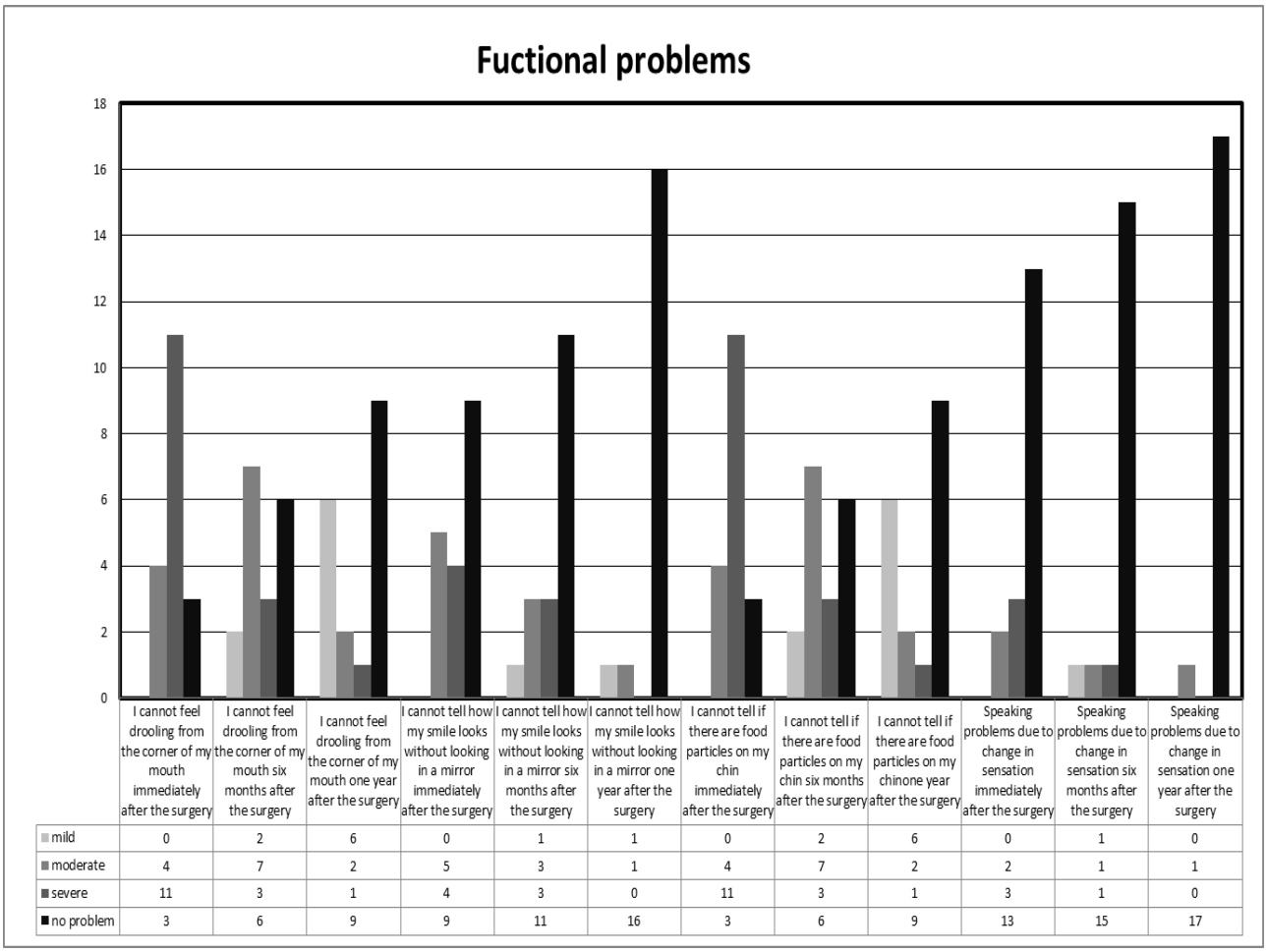
Table: When do you feel the change in sensation and how would you describe change in sensation.

		Spontaneous N (%)	*Evoked N (%)*	*Both N (%)*	*No Alteration N (%)*
When do you feel the change in sensation	Immediately after the surgery	2 (11.1)	7 (38.8)	8 (44.4)	1 (05.5)
	Six months after the surgery	1 (05.5)	9 (50)	6 (33.3)	2 (11.1)
	One year after the surgery	1 (05.5)	5 (27.7)	4 (22.2)	8 (44.4)
		No alteration	*Hypoaesthetic*	*Paresthetic*	*Dysesthetic*
How would you describe change in sensation	Immediately after the surgery	1 (05.5)	17 (94.4)	0 (100)	0 (100)
	Six months after the surgery	2 (11.1)	13 (72.2)	1 (05.5)	2 (11.1)
	One year after the surgery	8 (44.4)	7 (38.8)	1 (05.5)	2 (11.1)



	Numbness Immediately after the surgery	Numbness Six months after the surgery	Numbness One year after the surgery	Altered sensation in lips and mouth Immediately after the surgery	Altered sensation in lips and mouth Six months after the surgery	Altered sensation in lips and mouth One year after the surgery	Lips feel less sensitive to touch immediately after the surgery	Lips feel less sensitive to touch six months after the surgery	Lips feel less sensitive to touch one year after the surgery	Pain due to altered sensation immediately after the surgery	Pain due to altered sensation six months after the surgery	Pain due to altered sensation one year after the surgery
Mild	0	6	5	1	4	3	0	3	5	0	0	0
Moderate	9	7	4	5	5	2	7	9	5	0	0	0
Severe	8	1	2	4	0	0	9	2	0	0	0	0
No Problem	1	4	7	8	9	13	2	4	8	18	18	18

Figure 1: Problems with altered sensation.



	I cannot feel drooling from the corner of my mouth immediately after the surgery	I cannot feel drooling from the corner of my mouth six months after the surgery	I cannot feel drooling from the corner of my mouth one year after the surgery	I cannot tell how my smile looks without looking in a mirror immediately after the surgery	I cannot tell how my smile looks without looking in a mirror six months after the surgery	I cannot tell how my smile looks without looking in a mirror one year after the surgery	I cannot tell if there are food particles on my chin immediately after the surgery	I cannot tell if there are food particles on my chin six months after the surgery	I cannot tell if there are food particles on my chinone year after the surgery	Speaking problems due to change in sensation immediately after the surgery	Speaking problems due to change in sensation six months after the surgery	Speaking problems due to change in sensation one year after the surgery
mild	0	2	6	0	1	1	0	2	6	0	1	0
moderate	4	7	2	5	3	1	4	7	2	2	1	1
severe	11	3	1	4	3	0	11	3	1	3	1	0
no problem	3	6	9	9	11	16	3	6	9	13	15	17

Figure 2: Functional problems due to altered sensation.

Discussion

The bilateral sagittal split osteotomy can result in damage to the inferior alveolar nerve, mental nerve, lingual nerve and facial nerve. The damage in result can range from change in sensation to complicated neuropathic pain.[16,17] These symptoms can result in pain, discomfort for the patient.[18] Two studies concluded that post surgically numbness or altered sensation is an important factor in determining the patient's overall satisfaction after the treatment.[19,20] The sensations tend to come back but some patient may not fully recover for their whole life.[21] The true prevalence of the damage to terminal branches of the trigeminal nerve after the oral and maxillofacial surgery is unknown but severe injuries with everlasting disability symptoms are rare.[22]

Another study reported the incidence of trigeminal neuropathy in patients visiting the oral and maxillofacial unit of the University hospital of Leuven in 2013. Total 15.27% of the neuropathy in patients was caused by orthognathic surgery and 53% of these patients fully recovered after the first year of surgery[22] whereas in the current study 44.44 % of the patients fully recovered after one year.

One more study reviewed complications following the orthognathic surgery, and reported that half of the injuries i.e. 50% were in the form of nerve injury, followed by Temporomandibular joint disorder (14%), hemorrhages (9%), hearing problems (7%), infections (7%) and relapse (4%).[23] The current study only determined the nerve injury caused by the orthognathic surgery which was found to be 94.4% immediately after the surgery and 55.6% after one year of surgery. Mostly difficulty was reported by patients whose sensations were uncomfortable or painful i.e dysesthetic sensations followed by those whose sensations were not painful but were sensations not usually present in a healthy individual i.e. paresthetic sensations, and then were those who experienced only a simple loss in sensation i.e hypoesthetic sensations.[24]

In the current study, no patient reported dysesthetic sensation immediately after the surgery and only two patients reported dysesthetic sensation one year after the surgery.

In a study by Upton et al reported that during the first 6 months following surgery the most frequently selected words were numbness (approximately 60% of the patients), prickling (26%) and tingling (39%).[18] In the current study the most frequent word used in the first six months were numbness and swollen (92.8%) which come under the category of hypoesthetic.[25]

The neurosensory testing for determining the injury of nerve or altered sensation is a useful tool but patient's subjective report can act as a more sensitive tool to determine the extent and presence of injury following the orthognathic surgery. Another important factor is that variations in threshold methods of sensory tests cannot be fully understood in absence of patient's subjective report of altered sensation.[26]

Agbaje and Saleem conducted a study to evaluate the current testing modalities to determine the damage to nerve and he reported that there is a need to establish a standard test to determine the severity of nerve damage.[15] The first step in diagnosis and determination of nerve injury should involve the patient interview regarding qualitative description of sensory complaint.[27]

More than half of the operated subjects have some sort of paresthesia one year after the surgery. But only two patients had functional problem and one patient had speaking problem due to altered sensation. The limitations of the current study are the limited number of patients, one center and only post-operative subjective analysis of the paresthesia. In future another multi centered study can be conducted in which preoperative subjective and objective analysis can be compared with post-operative subjective and objective analysis.

Conflict of interest: None declared.

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