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RESEARCH ARTICLE

Evaluation of Neurosensory Deficits in Maxillofacial Surgery

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ABSTRACT

It is a prospective study to evaluate the neurosensory deficits in patients that came to MGM Dental College and Hospital, Navi Mumbai from January 2010 to November 2011. One hundred seventy-seven patients were evaluated and they were divided into three subgroups: trauma, surgical extractions and pathology. The study was conducted to evaluate the sexwise, agewise, the description of the neurosensory deficit, the most susceptible area of neurosensory deficit as well as the agewise and sexwise recovery pattern of the neurosensory deficit. The statistical analysis showed that the neurosensory deficits were more common than females, the age group in which the deficits were more common was in between 25 and 50 years. The area most commonly affected was the chin and lower lip. The recovery patterns also showed that males and the age group of 25 to 50 years showed faster recovery.

Keywords: Neurosensory deficits (NSD), Neuropraxia, Axonotmesis.

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INTRODUCTION

Maxillofacial neurosensory deficits may be caused by various factors like trauma, pathologies causing compression of the nerves, or may be postsurgical. These can cause minimal to severe disability affecting the patients' daily activities and quality of life. A disparity exists among the testing methods recommended to evaluate these deficits in the orofacial region. Controversies over the superiority of the subjective and objective testing *vs* intraoperative testing of the sensory nerve conduction velocity have resulted in an evolution of plethora of testing devices and methods. No set protocols exist to identify and deal with such complications.

Clinical neurosensory testing is generally divided into two basic categories based on the specific receptors stimulated by cutaneous contact, mechanoceptive and nociceptive. Each clinical testing is specific for different fibres.[4] Aims and objectives were to determine the incidence of neurosensory deficits in the maxillary and mandibular regions among patients undergoing various maxillofacial surgeries, to evaluate the description and duration of sensory loss, to assess the recovery pattern following nerve injury at regular intervals and to determine the most common etiological factors associated with persistent neurosensory deficits.

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PATIENTS AND METHODS

Source of data included a questionnaire to evaluate the subjective and objective clinical findings among patients of MGM Dental College and Hospital. Study population included patients of MGM Dental College and Hospital. Ethical clearance was obtained from the Ethical Committee of Maharashtra University of Health Sciences (MUHS). In this study, 177 patients who have undergone treatment at the Department of Oral and Maxillofacial Surgery, MGM Dental College and Hospital were evaluated. The 177 patients included 50 trauma patients, 111 patients who underwent surgical extractions, 16 patients who underwent osteotomies and surgery for respective pathologies. Inclusion criteria included patients with neurosensory deficits in the maxillofacial region following surgery in that area and patients which were evaluated both preoperatively and postoperatively, only adult patients were included as subjective evaluation requires mature assessment and reply and only the areas supplied by the 2nd and 3rd divisions of trigeminal nerve were included in the study. Clinical neurosensory testing was performed from January 2010 to November 2011. The patients were evaluated preoperatively and postoperatively for a period of 1 year at regular intervals of 3 days, 21 days, 3, 6, 9 and 12 months respectively. Evaluation of neurosensory disturbances consisted of subjective and objective assessment. Subjective assessment included the patients perception of sensory or functional neural alterations. Objective assessment was performed using two point discrimination, static light touch, brush directional stroke, pin prick and thermal discrimination. The resulting data was coded and statistical analysis was done using statistical package for social sciences (SPSS) software version 17.0. The statistical significance was assessed by Chi-square test and level of significance was fixed 0.05%.

RESULTS

In the fracture subgroup, out of 50 patients 29 patients had neurosensory deficit (58%) and 21 patients (42%) had normal sensation. In the surgical extractions subgroup, 5 patients (5%) had neurosensory deficits while 106 patients (95%) had a normal sensation. In the miscellaneous subgroup, 6 patients (37%) had neurosensory deficit while 10 patients (63%) showed normal sensation. This had a Pearson Chi-square value of 49.988 with df of two significance was 0.0001 which means it was highly significant that the neurosensory deficits were more common the fracture group (Fig. 1).

In the fracture subgroup in males, 20 patients (43%) showed normal sensation while 28 patients (57%) showed neurosensory deficit while in females 1 patient (50%) showed normal sensation and 1 patient (50%) showed neurosensory deficit. In surgical extractions subgroup in males, 68 patients (94%) showed normal sensation while 4 patients (6%) showed neurosensory deficit while in females 38 patient (97%) showed normal sensation and 1 patient (3%) showed neurosensory deficit. In miscellaneous subgroup in males 4 patients (50%) showed normal sensation while 4 patients (50%) showed neurosensory deficit while in females 6 patient (75%) showed normal sensation and 2 patient (25%) showed neurosensory deficit. Pearson Chi-square test showed that neurosensory deficits showed more predilections for men with a value of 6.971, df of 1, significance of 0.008 (Fig. 2).

In the fracture subgroup according to age, 5 patients (24%) were below 25 years, 15 patients (71%) were between 25 and 50 years and 1 patient (5%) was above 50 years. In the surgical extractions subgroup, 38 patients (36%) were below 25 years, 68 patients (64%) were between 25 and 50 years. In the miscellaneous subgroup, 5 patients (50%) were below 25 years and 5 patients (50%) were between 25 and 50 years. Among the 40 patients with neurosensory deficits in fracture subgroup 12 (41%) were below 25 years and 17 (59%) were between 25 and 50 years of age. In the surgical extraction subgroup, 2 (40%) were below 25 years, 1 (20%) was between 25 and 50 years and 2 (40%) were above 50 years. In the miscellaneous subgroup, 4 (67%) were below 25 years and 2 (33%) were between 25 and 50 years (Fig. 3).

The evaluation of site of neurosensory deficit showed more predilection for lower lip and chin seen in 23 (13%) cases out of 177 patients. This study showed the Pearson Chi-square test significant with a value of 16.204, df 10 and significance value of 0.003 (Fig. 4).

The evaluation of description of neurosensory deficit showed that 29 patients (16%) of 177 patients had a decreased sensation (Fig. 5).

The recovery patterns for the males in the fracture subgroup were 13 of the patients recovered sensation after 6 months and 9 patients recovered after 1 year while 6 patients did not recover while for the females 1 patient did not recover after the valuation period of 1 year. In the surgical extractions subgroup, 1 male and 1 female recovered sensation after 1 year of evaluation period while 3 males did not recover after the 1 year evaluation period. In the miscellaneous group, 1 male and 1 female recovered after 1 year while 3 males and 1 female did not recover after the evaluation period. On the whole the among the males 13 recovered sensation after 6 months while 11 patients recovered after 1 year while 12 patients did not recover after 1 year evaluation period. Among the females, 2 recovered after 1 year evaluation period while 2 did not recover (Fig. 6).

The recovery patterns as per the age of the patient showed that in the fracture subgroup among the age group below 25 years, 4 patients recovered after 6 months and 3 patients recovered after 1 year while 2 patients did not recover and in the age group between 25 and 50 years, 10 patients recovered after 6 months and 10 patients recovered after 1 year while 5 patients did not recover. In surgical extractions subgroup among the age group below 25 years 1 patient recovered after 1 year 4 patients while 1 patient did not recover, in

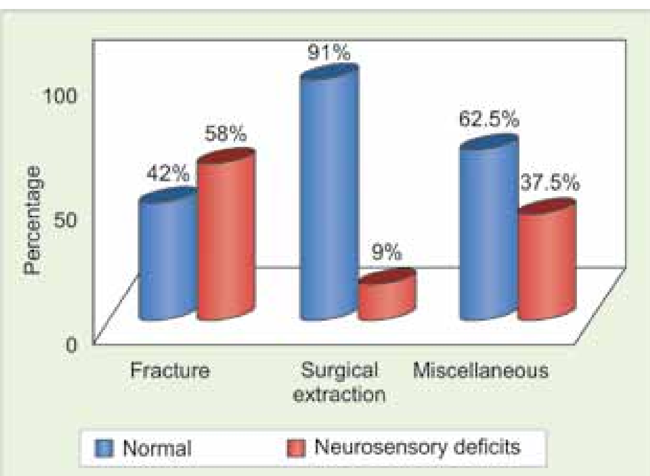

Fig. 1: Groupwise distribution of neurosensory deficits

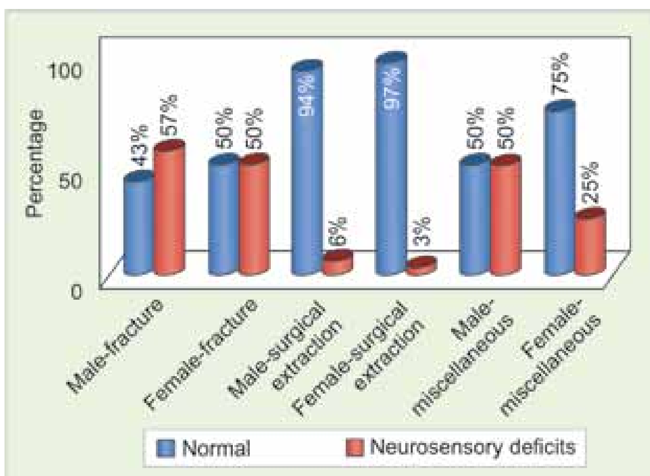

Fig. 2: Sexwise distribution of neurosensory deficits

the age group between 25 and 50 years, 1 patient did not recover and in the age group of more than 50 years 1 patient recovered after 1 year while 1 patient did not recover. In miscellaneous subgroup in the age group of below 25 years 1 patient recovered after 1 year while 3 patients did not recover and among the age group between 25 and 50 years 1 patient recovered after 1 year while 1 patient did not recover. On the whole in the age group below 25 years 4 patients recovered after 6 months while 5 patients recovered after 1 year and 6 patients did not recover. In the age group between 25 and 50 years 11 patients recovered after 1 year while 10 patients recovered after 6 months and 6 patients did not recover. In the age group above 50 years 1 patient recovered after 1 year while 1 patient did not recover (Fig. 7).

DISCUSSION

The total number of patients included in this study were 177 out of these 40 patients had a neurosensory deficit. In the fracture subgroup, out of 50 patients 29 (58%) suffered from neurosensory deficits. In the surgical extractions subgroup out of 111 patients 5 (5%) out of which 4 (4%) were IAN deficits and 1 (1%) were lingual nerve deficits. In the miscellaneous subgroup, out of 16 patients 6 (37%) had neurosensory deficits. The miscellaneous subgroup was subdivided into osteotomy and pathology categories. The osteotomy category showed 3 cases BSSO (setback) all of which showed postoperative neurosensory deficit (100%) and 2 of them persisted for more than 1 year. From the pathology subgroup, 3 patients had neurosensory deficit out of which 2 patients did not recover after 1 year follow-up.

The higher incidence of the neurosensory deficit among patients undergoing the BSSO procedure was similar to that seen by other authors.[1,2]

The reasons for such a high degree of NSDs are as follows:

- Authors using intraoperative recording of somatosensory, evoked potentials indicated that the initial medial retraction of the inferior alveolar neurovascular bundle during the preparation of the osteotomy cuts was the consistent factor for neuropraxia.[3]

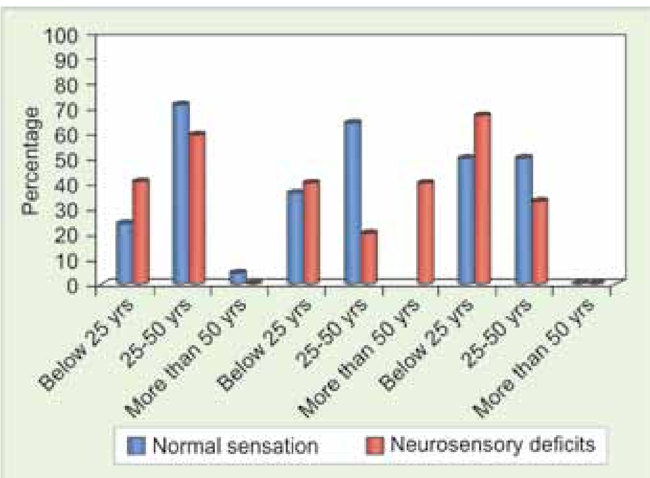

Fig. 3: Agewise distribution of neurosensory deficits

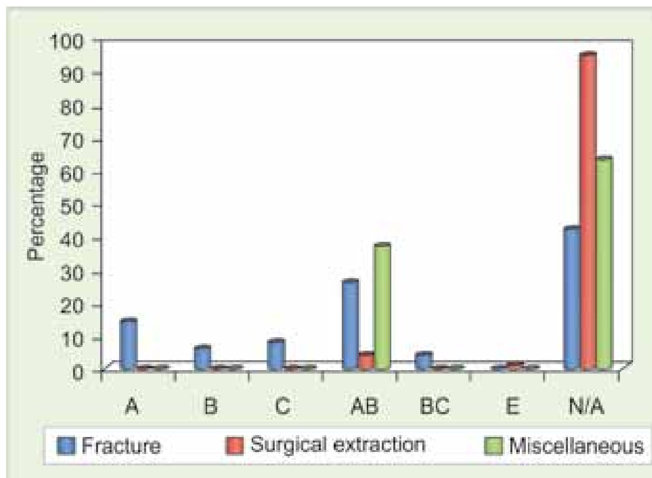

Fig. 4: Areawise distribution of neurosensory deficits

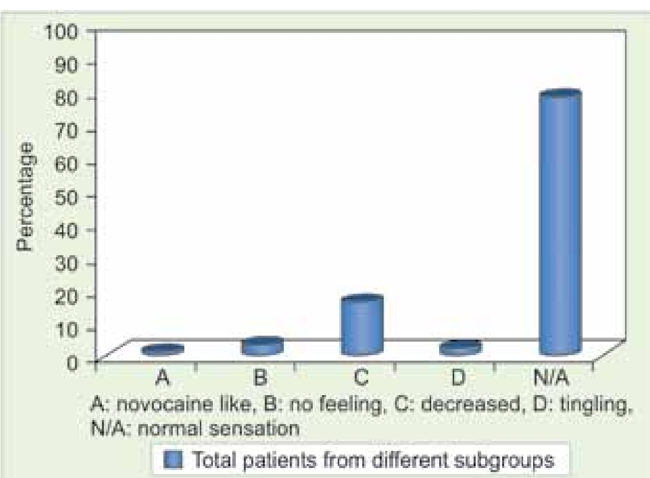

Fig. 5: Distribution of neurosensory deficits according to patient perception

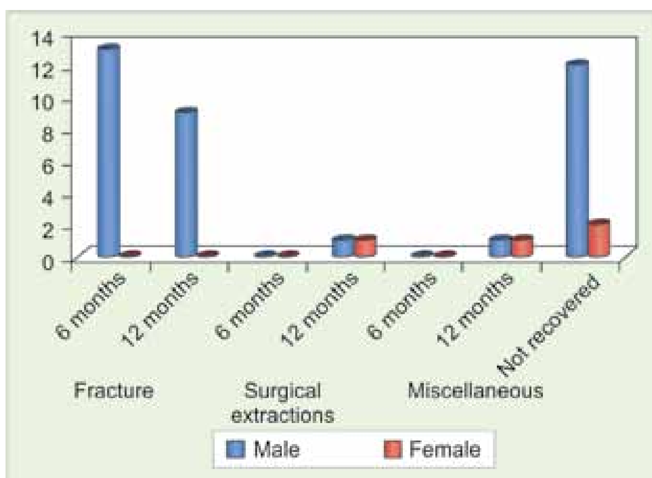

Fig. 6: Sexwise evaluation of recovery

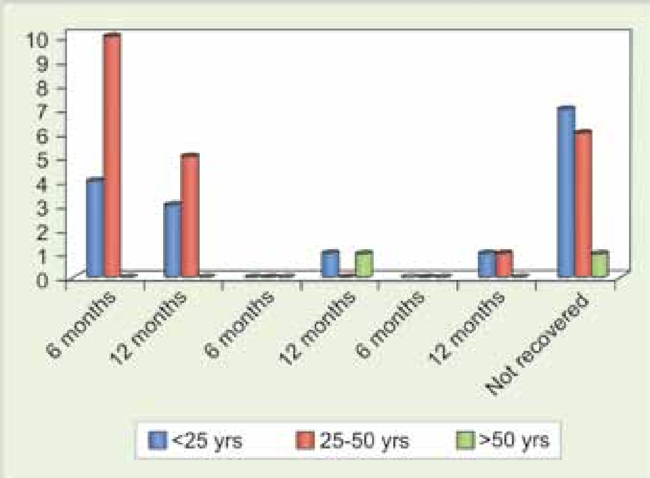

Fig. 7: Agewise evaluation of recovery

- The highest risk of nerve injury was at the time of actual split.[5,6]
- Bad split occurring at the time of surgery also could lead to sensorial changes.
- Subsequent fixation of the osteotomised segments with the bicortical screws may injure the inferior alveolar nerve during drilling or screw placement. It is therefore likely that compression of the nerve during fixation is one of the major reason for nerve dysfunction.[1]
- There is evidence in literature which states that setback procedures may compress the bundle at its point of entry into the medial aspect of the ramus whereas the advancement procedures increase the dimension of the mandibular foramen and decompress the nerve but increasing advancement may lead to traction neuropraxia.[7]

Genderwise our study was significant since there was definite predilection for males found in the study.

The surgical extraction subgroup showed that the inferior alveolar nerve was affected 0.03% while lingual nerve was affected in 0.009% of the cases. Previous literature has showed a range of 0.26 to 8.4% for inferior alveolar nerve deficits while for lingual nerve deficits it is 0.1 to 22%.[11] The less percentage of NSD in our study may be attributed to the technique followed. Surgical extractions of all the cases was from buccal approach and since lingual split technique was not used, there were minimum chances of damaging the lingual nerve. Also due to better preoperative assessment of the relation of the tooth to the inferior alveolar canal and modified surgical technique. Due to these reasons, the nerve deficits in this subgroup could be less compared to previous studies.

In the subgroup of fracture patients out of the 29 patients with neurosensory deficit 28 were males 1 was a female. Maximum patients were in the age group of 25 to 50 years (64%).

The anatomical course of the inferior alveolar nerve and infraorbital nerve make them susceptible to nerve damage following fracture of the facial skeleton. Both these nerves pass through relatively narrow bony canals where small fragments of bone or edema inside the canal lead to longer period of compression. Similarly, soft tissue associated with the emergence of inferior alveolar nerve at mental foramen and infraorbital nerve at infraorbital foramen of have scarce protection from direct trauma.[8]

Specifically fractures displaced greater than 5 mm had a 6 fold increased risk for an adverse effect on the neurosensory score after treatment compared to patients with fracture displacement 5 mm or less.[10]

Patients with normal post injury and pretreatment neurosensory scores have 25 fold increased risk of a worse neurosensory score after treatment compared with abnormal postinjury/pretreatment scores.[9]

Griffith et al have emphasized that in the event of lingual or inferior alveolar nerve damage associated with medially displaced condyle it is advisable to obtain a computed tomography (CT) scan to assess the precise anatomic location of the foramen ovale.

Of the various neurosensory testing modalities used in assessing neurosensory deficits the 2-point discrimination was the most useful.

However, the brush directional stroke too could be useful indicator as brush directional stroke requires complex integrated sensory function that could be lost secondary to deaffrentiation changes in the synaptic integration centers accompanying loss of peripheral nerves.

The thermal discrimination is not very reliable. The maintenance of thermal discrimination in this study group has several limitations in that the test would be positive in spite of a true negative with regard to neurosensory deficits. This could be attributed to the small fibers, such as C and A delta fibers as they are able to regenerate faster.

Light touch is also a representative standard of neurosensory testing. Although, the test is not very reliable it can be thought to be reproducible time and again.

Pin prick might show sensitivity but may not be a very reliable method.

In this study, the objective evaluations done were quite significant according to the statistics provided. The objective tests showed that 7 patients in the fracture subgroup, 3 patients in the surgical extractions subgroup and 4 patients in the miscellaneous subgroup showed neurosensory deficit while 3 patients with maxillary deficits and 11 patients with mandibular deficits did not show recovery.

CONCLUSION

The study evaluated 177 patients. For ease of evaluation the sample size was categorized into the fracture, surgical extractions and miscellaneous (osteotomy and pathology) subgroups. The study revealed among the various surgical subgroups, the fracture subgroup had the highest incidence of neurosensory deficits, followed by miscellaneous and surgical extraction subgroups. The 12 month follow-up turned out to be a satisfactory period indicating that maxillofacial nerve injuries were usually axonotmesis type.

The results of the study indicate that prospective assessment provides an important modification of previously described testing regimens.

The fact that the equipment necessary to perform neurosensory evaluation is relatively inexpensive and commercially available and less time consuming it makes the examination very conducive. But certain rules must be adhered to during these tests. For example, visual and acoustic effects must be prevented, the tests should be performed by the same person and the tests must be done in the following order:

Two point discrimination- Static light touch- Brush directional stroke- Pin prick- Thermal discrimination.[4]

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