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Original research

Alveolar nerve impairment following bilateral sagittal split ramus osteotomy and genioplasty

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ABSTRACT

Objective: Permanent sensory changes after sagittal split osteotomy have been estimated by various methods of measure. The incidence after sagittal split osteotomy vary considerably. The purpose of this study was to evaluate sensory alterations in patients treated either with sagittal mandibular osteotomy and genioplasty or only with sagittal mandibular osteotomy. The type of sensory alteration and the times of recovery of lower lip sensitivity was also checked in the different groups.
Methods: 106 patients who underwent BSSRO w/o genioplasty, during a 4-year period, were included. Qualitative and quantitative tests were applied to investigate tactile sensitivity, providing objectively measurable data involving the ability to feel the stimulus and to discriminate a two points static stimulus. Thermal sensitivity, sharp/blunt discrimination were also evaluated, as well the quality of subjective sensory symptoms.
Results and conclusion: Eighteen months after surgery, almost all of the patients had satisfactory recovery of their initial skin and mucosal sensory deficits, but the intensity of more fine discriminative sensitivity was reduced in those who had simultaneously undergone genioplasty associated with BSSRO.

1. Introduction

Surgical repositioning of the skeletal components of the facial structure can be used to improve function and aesthetics. An extensive number of osteotomies are performed within the maxillofacial region to fulfil these purposes. The most commonly used are the Le Fort I osteotomy of the maxilla, the bilateral sagittal split ramus osteotomy (BSSRO) and genioplasty of the chin area [1]. A proliferation of such treatments has occurred, owing to the increasing need to improve facial appearance and resolve functional deficits, such as difficulties in mastication and speech. Various benefits have been reported, including improved masticatory function, reduced temporomandibular joint pain and improved facial aesthetics [2]. However, as the number of surgical performances increases, numerous complications, such as vascular problems, temporomandibular joint problems, nerve injuries and infections, have also been reported more frequently [3].

Neurosensory deficits are reported to be the most common problem following orthognathic surgery [4]. Sagittal split osteotomy and intraoral vertical ramus osteotomy are the most commonly used osteotomies to correct mandibular deformities. Altered function of the inferior alveolar nerve sometimes complicates mandibular osteotomy and is indicated by sensory changes in the distribution of the mental nerve (the lower lip and the chin). The incidence of permanent sensory changes after sagittal split osteotomy has been estimated by various subjective and objective measures, which vary considerably in their ability to detect and quantify any deficit. In some studies, the incidence after sagittal split osteotomy ranged from 0% to 82%. [5]

Injuries to the inferior alveolar nerve during the osteotomies operation may result from stretching of the nerve during medial retraction, adherence of the nerve to the proximal segment after

☆ AsianAOMS: Asian Association of Oral and Maxillofacial Surgeons; ASOMP: Asian Society of Oral and Maxillofacial Pathology; JSOP: Japanese Society of Oral Pathology; JSOMS: Japanese Society of Oral and Maxillofacial Surgeons; JSOM: Japanese Society of Oral Medicine; JAMI: Japanese Academy of Maxillofacial Implants.

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splitting, direct manipulation of the nerve, bony roughness on the medial side of the proximal segment or mobilisation of the segment. The relation of the mandibular canal to the lateral cortex of the mandibular ramus can affect the incidence of nerve damage. In addition, osteosynthesis tools may cause injuries via compression of the inferior alveolar nerve during fixation or direct injury to the nerve [1,6,7].

Virtually all patients have altered sensation in the immediate post-operative period, but even in the long term, more than one-third of patients report subjective sensory disturbances [8–10]. The extent and course of nerve recovery vary greatly in studies in which the subjective sensation has been followed at several time points up to 1 year, but little attention has been paid to factors that could explain the variance.

Persisting sensory alterations can cause problems in the daily lives of patients and decreased satisfaction with the treatment results. Detailed knowledge of the recovery pattern and extent of the sensory alterations would be of great importance for patient communication, as well as for determining the need for possible further diagnostic tests and treatments during the recovery phase [11]. Therefore, one must carefully evaluate the degree of neurosensory disturbance (NSD) and its treatment and prognosis at an early stage after surgery. Such evaluation would be very helpful for clinicians and their patient.

For evaluating the NSD of the chin, many types of neurosensory status examinations are used [5–7,11–14], which can be classified into three groups: measurements of touch, pain and thermal sensation. Physiologically, touch sensation is transmitted by A-beta fibres, thermal sensations by C fibres and pain and cold sensations by A-delta and C fibres, respectively [13]. Therefore, to increase the diagnostic accuracy of the testing and to detect different types of damage, various tests should be combined, such as combination of touch sensory in objective and subjective manners.

The purpose of this study was to verify if substantial differences exist in terms of sensory alterations between patients treated either with sagittal mandibular osteotomy and genioplasty or only with sagittal mandibular osteotomy. It was also our intention to identify the types of sensory alteration and the times of recovery of lower lip sensitivity in the different groups.

2. Patients and methods

The clinical records of the patients who underwent BSSRO alone or combined bimaxillary osteotomies at the Maxillofacial Surgery Unit of the Sassari University Hospital, Italy, during a 4-year period between 2009 and 2013, were examined.

Patients who had conditions with greater propensity to alter recovery patterns or complicated systemic conditions, such as a persisting orofacial sensory impairment, diabetes, a history of facial trauma or operation or significant psychiatric disorders was excluded from the study group. Prior to surgery, nerve function was tested bilaterally to document any deficits due to the presence of concomitant disease; no such deficits were encountered. All patients followed an ordinary recovery course after surgery and none showed severe post-operative complications, such as persistent oedema or infection. The study was approved by the ethical committee of the University of Sassari.

The same surgeon, who was experienced in orthognathic surgery, performed all surgeries. All patients were treated with sagittal mandibular ramus osteotomy (Epker's variant), associated or not with genioplasty (at the lower border from the first premolar area of one side to the same area on the opposite). Both osteotomies were performed with a reciprocating saw and then splitted with sagittal splitter and separators. Ostheosintesis was done with titanium plates and screws.

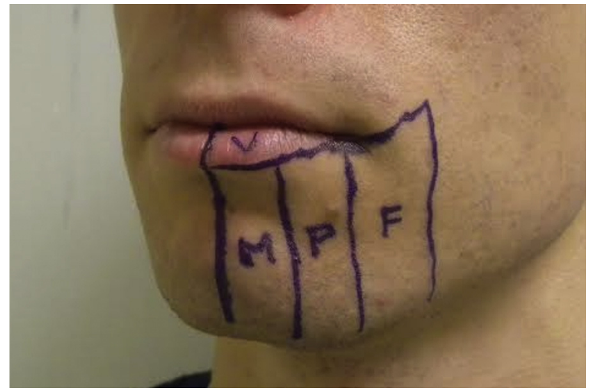

Fig. 1. Cutaneous areas tested. V: vermilion. M: median region. P: paramedian region. F: foramen.

The subjects included (106 patients, 66 men and 40 women; mean age: 26.1 years, range: 21–37 years) were divided into the following groups:

Group 1: class III, mandibular retrusion without genioplasty (28 patients)

Group 2: class III, mandibular retrusion plus genioplasty (28 patients)

Group 3: class II, mandibular advancement without genioplasty (26 patients)

Group 4: class II, mandibular advancement plus genioplasty (24 patients)

To obtain a precise map of the sensitivity of the region pertaining to the inferior alveolar nerve (and particularly the mental nerve), the region itself was divided into the following areas (Fig. 1):

- the median region of the chin and lip: 1 cm bilaterally from the symphysis mandibulae, both the cutaneous and mucosal sides;
- the paramedian region: 2 cm bilaterally from the symphysis, both cutaneous and mucosal sides;
- the area of the mental foramen: 3 cm bilaterally from the symphysis (a few millimetres below the roots of the 4th and 5th teeth), on both the cutaneous and mucosal sides;
- the vermilion border of the lower lip.

The function of the inferior alveolar and mental nerves was tested for 18 months after surgeries.

All the tests were carried out by an independent medical doctor in a room free of any acoustic or visual disturbances capable of affecting the tests, with the patients having their eyes closed. The results were recorded on a standard form.

Qualitative and quantitative tests were applied to investigate tactile sensitivity, providing objectively measurable data involving the ability to feel the stimulus and to discriminate a two points static stimulus. Thermal sensitivity, and sharp/blunt discrimination were also evaluated, as well the quality of subjective sensory symptoms.

2.1. Tactile sensitivity

Objective and quantitative evaluations were performed using the Semmes–Weinstein pressure aesthesiometer. The facial skin sites were tested bilaterally while the patients kept their eyes closed. The points of stimulation were selected in random order.

The test started with the thinner filament, followed by filaments with progressively increasing thickness. The patient was asked to answer yes when the touch of the monofilament was felt. Then, a filament immediately thicker was tested, but only in the areas without positive response to the previous filament. Each stimulus

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