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Clinical Paper
TMJ Disorders

Clinical and electromyographic assessment of facial nerve function after temporomandibular joint surgery

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Abstract. The aim of this study was to evaluate the factors that may cause alterations in facial nerve function during temporomandibular joint (TMJ) surgeries. Forty-six patients were included (66 joints) between the years 2000 and 2007. Study patients were those undergoing various surgical procedures for the treatment of TMJ disorders. Patients who had made an incomplete recovery from a facial nerve injury resulting from a previous operation and patients who presented with facial palsy after a previous TMJ surgery were excluded. The facial nerve function of all patients was evaluated at different time intervals using a facial nerve grading system, motor unit action potentials of the frontalis and orbicularis oculi muscles, and a facial nerve latency test. Various degrees of facial nerve affliction were initially noticed in 71% of the study cases (47 of 66 joints). Statistical analyses (χ^2 goodness-of-fit) revealed that several factors could lead to facial nerve injury following TMJ surgery, including the design of the skin incision, prior surgeries, type of surgery, and duration of surgery. Facial nerve injury during TMJ surgery is multifactorial. Electromyographic studies are non-invasive and valuable diagnostic and prognostic tools for assessing facial nerve function.

Key words: TMJ surgery; facial nerve; endaural; pre-auricular; FNLT; MUAP.

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Temporomandibular joint (TMJ) disorders represent a significant public health problem and are generally characterized by the presence of TMJ pain, tenderness, noise, and limitations of mouth opening.[1] TMJ disorders include infection, internal derangement, degenerative joint diseases, hypomobility/ankylosis, hypermobility, tumours, and traumatic injuries. Surgical management depends on the nature of the disorder.[2]

Regardless of the surgical procedure used for the management of TMJ disorders, there are potential complications. These include haemorrhage,[3] infection,[4] auriculo-temporal nerve syndrome,[5] otological complications,[6] trauma to the parotid gland,[7] and facial nerve injury. Both the temporal and zygomatic branches of the facial nerve are at particular risk of injury during TMJ surgery.[8] The facial

nerve is the main anatomical structure that the surgeon should consider when performing the surgical approach to the TMJ. Skill in preserving its functional integrity is a critical factor when this type of surgery is performed.[9]

The incidence of facial nerve injury during TMJ surgeries varies among surgeons. There are many factors that could contribute to the injury of the temporal and zygomatic branches of the facial nerve.[10] These nerves lie in a confluence of superficial fascia, temporalis fascia, and periosteum, and may be injured by any dissection technique that attempts to violate the integrity of these regions. Excessive or heavy-handed retraction causes compression and/or stretching of nerve fibres resulting in neuropraxia; this may be the reason for a significant number of nerve injuries associated with TMJ surgery.[11]

Facial nerve injury may also be caused by inadvertent suture ligation of facial nerve branches, particularly during wound closure. In order to prevent this undue complication, deep blind bites with the suture needle should be avoided. The use of electrocautery in deep sites that are potentially close to facial nerve branches, or within the parotid gland, should also be avoided. Furthermore, one should avoid crushing or clamping tissue indiscriminately, particularly during episodes of brisk bleeding.[12] Excessive swelling or haematoma formation may result in transient facial nerve injury. Also, patients with previous TMJ surgery have an increased incidence of facial nerve injury.[9]

The aim of this study was to assess the common elements encountered during TMJ surgeries that may cause facial nerve injury. The present study was conducted on a group of patients who underwent surgical procedures to treat various TMJ disorders, in order to evaluate the different factors that may contribute to facial nerve injury during TMJ surgery.

Patients and methods

In order to explore the factors that play a role in the incidence of facial nerve injury following TMJ surgery, this study recruited patients who had been diagnosed with a TMJ disorder that mandated a surgical intervention. This prospective study included 46 consecutive patients (32 females and 14 males) who underwent surgery for the treatment of TMJ disorders between the years 2000 and 2007. All study patients were recruited from the outpatient clinics of the oral and maxillofacial surgery departments of Al-Azhar University hospitals in Cairo, Egypt, between the years 2000 and 2007. The institutional ethics committee of the host institution reviewed and approved the study. After obtaining written patient consent, appropriate surgical procedures for the treatment of TMJ disorders were performed following careful clinical and radiographic evaluation to determine the nature of the disorder. The same surgical team performed all of the operations.

The reference surgery for this study was the surgical procedure undertaken for the treatment of the TMJ following the patient's recruitment into the study. In order to be included in the study, the reference surgery needed to be either the patient's first surgery to treat a TMJ disorder, or if she/he had undergone prior surgery, she/he was required to have no residual facial nerve dysfunction or injury following the prior procedure(s). Patients who had made an incomplete recovery from a facial nerve injury following previous TMJ or other maxillofacial surgeries and patients who presented with facial nerve palsy were excluded. Patients with a history of previous surgical treatment of the TMJ were screened preoperatively by electromyography (EMG) for motor unit action potentials (MUAPs) of the frontalis and orbicularis oculi muscles and underwent a facial nerve latency test (FNLT) to determine whether there was complete recovery of the facial nerve function. Other parameters of this study that were examined for correlation with the incidence and degree of facial nerve injury following the reference surgery were the type of surgery, surgical approach, and duration of surgery.

The House–Brackmann facial nerve injury grading system was used to grade facial nerve recovery following the reference surgery (Table 1).[13] The system involves a six-point scale, with grade I being normal function and grade VI being total paralysis.

Electrodiagnostic studies were performed using EMG or MUAP of the frontalis and orbicularis oculi muscles and FNLT. With regard to MUAP, all patients were classified into one of three groups in accordance with Danielides et al.[14]: (1) group A were those in whom the muscle response was 51–95% of the response of the healthy muscle; (2) group B were those in whom the muscle response was 25–50% of the healthy muscle; (3) group C were those in whom the muscle response was <24% of the healthy muscle. For FNLT, all patients was classified into one of three groups in accordance with Danielides et al.[15]: (1) group 1 were those in whom latency varied from 2.4 to 4 ms; (2) group 2 were those in whom latency varied from 4 to 6 ms; (3) group 3 were those in whom there was an absence of action potential (no response).

Postoperative evaluation of facial nerve function was performed at 24 h, 1 week, 1 month, 3 months, and 6 months. The reference values for 'normal function' were established for both MUAPs and FNLTs in each patient. In the case of patients undergoing unilateral joint surgery, the other 'non-operated' side of the face was used for reference values. In the case of patients undergoing bilateral joint surgery, preoperative MUAPs and FNLTs were collected and served as the reference values.

Table 1. The House–Brackmann facial nerve function grading system.

Grade	Description		Characteristics
I	Normal		Normal facial function in all areas
II	Mild dysfunction	Gross	Slight weakness noticeable on close inspection
		At rest	Normal symmetry and tone motion
		Motion	Forehead: moderate to good function Eye: complete closure with minimal effort
III	Moderate dysfunction	Gross	Obvious but not disfiguring difference between two sides
		At rest	Normal symmetry and tone motion
		Motion	Forehead: slight to moderate movement Eye: complete closure with effort
IV	Moderately severe dysfunction	Gross	Obvious weakness and/or disfiguring asymmetry
		At rest	Normal symmetry and tone motion
		Motion	Forehead: none Eye: incomplete closure
V	Severe dysfunction	Gross	Only barely perceptible motion
		At rest	Asymmetry
		Motion	Forehead: none Eye: incomplete closure
VI	Total paralysis		No movement