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Synkinesis of Facial Musculature in a Patient with Facial Paralysis

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Abstract Facial Synkinesis is a clinical condition that is the sequel to facial nerve paralysis which develops during nerve repair like axon myelination and regeneration. Involuntary muscle activity is accompanied by voluntary muscle activity and may involve facial and extra ocular muscles. This article describes an uncommon variation of facial Synkinesis that manifested clinically in weak voluntary chewing and frequent cheek biting in the form of mucosal erosion on the buccal mucosa. Managing a case of facial paralysis that has associated facial Synkinesis has also been discussed.

Keywords: *cranial nerve, motor, bells palsy, skeletal muscle, neuromuscular junction*

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1. Introduction

To conserve energy in the human body, almost all skeletal muscles act only voluntarily. An involuntary muscular movement accompanying voluntary movement's results from misfiring by the nerves and the condition is termed as Synkinesis, which develop as a sequel to nerve trauma (exception being the Duane-retraction syndrome). [1,2] The condition clinically is more evident in the muscles of the face rather than other parts of the body due to innumerable connections present between muscles and the size of the muscles (large muscles hardly show movements in response to the activity). This is why there are more reported cases of facial and extra ocular dyskinesis.

Facial Synkinesis is a common sequel to idiopathic facial nerve paralysis, also called Bell's palsy or Facial Palsy. [3] In such patients, facial Synkinesis inevitably develops during as part of attempts to repair after diffuse axon demyelination and degeneration. In some cases, treatment with electrical stimulation also has been shown to produce such effect. [4,5] Involuntary muscle activity may be symptomatically seen in eye, midface, neck and lacrimal glands. [6,7,8,9] This article describes an uncommon variation of Synkinesis which was symptomatic as weak voluntary chewing that ultimately resulted in angular chelitis, frequent cheek biting and at times blinking while eating in a patient with facial paralyses.

2. Case Report

A male patient, aged 32 years, was referred to the department of Prosthodontics from the department of Endodontics for a single crown placement in relation to endodontically treated maxillary right central incisor. The patient reported that he was presently suffering from facial paralysis since last 6 months and was seeking treatment in a private set up. There was no familial history of the condition reported by the patient, although one of his far relative was suffering from hemi paralysis suffered as a result of vehicle accident. No reported history of any recurrent nerve disorders existed in the family. Patients' present complaints included inability to chew efficiently on the affected side along with frequent biting into the cheeks on the unaffected side. The patient also reported ulceration at the angle of the mouth. Detailed questioning revealed that the patient used to take more time in eating, avoidance of certain food, especially meat, ability to apply adequate chewing forces, winking (blinking) while smiling and drooling of saliva. Other aspects of systemic health were non-contributory. Dental history revealed fairly good oral hygiene maintenance practices, although patient underwent endodontic treatment for a maxillary tooth as a result of an old trauma. The patient did not disclose any related cause to facial paralysis nor was there any history of previous surgery. Extra oral examination revealed the patient left side paralyzed with incomplete closure of the left eye (affected side) on the normal closing of the eyelids (Figure 1 A and B). Facial asymmetry was evident in relation to the angle of the

mouth on either side with left side lower than the right side. Facial asymmetry becoming more prominent when patient smiled. Intra oral examination revealed a healthy permanent natural dentition with low caries and periodontal index. The angle of the mouth on the unaffected side showed multiple small ulcerations with raw, bleeding areas (Figure 2 A) and intra oral mucosal erosions on the buccal mucosa in the region of first and second molars (Figure 2 B). Static and dynamic examination of the occlusion did not reveal any abnormality in occlusion or mandibular movements. The patient's treatment plan included restoration of the endodontically treated with all ceramic crown and due referral to the department of medicine for evaluation of the existing condition. After diagnostic mounting, it was more evident that patients existing complaints were not related to the dentition, but was more related to the healing of the existing facial paralysis. The basic scientific protocol was followed for fabrication of the all ceramic crown which in no way influenced patient's existing condition except in some form of gaining self-confidence.

Figure 1. (A) Affected side at the beginning of voluntary eyelid closure (B) Affected side at the end of voluntary eyelid closure

Figure 2. (A) Angular chelitis on unaffected side (B) mucosal erosion in the molar region associated with cheek biting

The patient was referred to the department of oral medicine and general medicine for management of the condition. After thorough investigations like serological tests, routine blood tests, brain MRI (magnetic resonance imaging) and routine electromyography (EMG) were done, existence of any underlying abnormality that could cause undue pressure on the nerve (like brain tumour) or presence of any nerve damage was ruled out. During the course of prosthodontic treatment, patient was advised to receive treatment for Synkinesis in the form of biofeedback and facial retraining from experts in the field of physical training and medicine. The all ceramic crown was also cemented during this course. The patient was satisfied with the outcome of prosthodontic as well as a treatment for facial paralysis.

3. Discussion

Bell's palsy is often encountered in a dental clinic and two most common types of Synkinesis that every dentist should be aware of are Synkinesis involving facial muscles and extra ocular muscles. A case of Bell 's palsy that involves facial Kinesis has been described in this report. Although the exact cause of such nerve behavior is not known, its mechanism can be explained on the basis of three different hypotheses namely aberrant nerve regeneration, Interneuronal ephaptic transmission and nuclear hyper excitability. Aberrant nerve regeneration (most widely accepted) states that during repair the axons project from the facial nucleus to incorrect peripheral muscle groups resulting in aberrant nerve branches that can simultaneously innervate different subdivisions of the facial nerve. [4] The theory of ephatic transmission states communication between two nerves occurs via an artificial synapse. Any nerve that undergoes repair and is non myelinated acts as artificial synapse thereby nonmyelinated nerves act like noninsulated wires that are able to send action potentials in both directions. [10], [11] Alternately, the third hypothesis states that nuclear hyper excitability as a result of axonal degeneration wherein a post synaptic cell has been deprived of an input becomes more sensitive to neurotransmitters that are provided by residual undamaged axons within the same area of nerve damage. Synkinesis associated with Bell's palsy that is based on nuclear hyper excitability is being supported by more researchers. [12] Patients weak voluntary chewing in our case could thus be as a result of inappropriate stimulation to the muscles which actually may mimic the Synkinesis stimulation of the associated nerve.

Although these theories do describe the associated symptoms in this case, however, symptoms on the other side (unaffected side) like frequent cheek biting can be directly related to patient's weak voluntary chewing ability on the affected side. This in turn stimulates one to put extra effort on the unaffected side which may lead to cheek biting. Also coordinated collection of bolus by the muscles of cheek on either side is due to simultaneous stimulation of nerves on either side which in this case is affected.

Managing Synkinesis associated with facial nerve paralysis includes firstly assessment using Synkinesis Assessment Questionnaire (SAQ) [8] followed by either facial retraining, biofeedback or surgery that may involve myectomy or neurolysis, mime therapy and the use of Botox. [13,14] The condition of the present patient,

however improved considerably with retraining and biofeedback where he was taught to voluntarily control the involuntary acting musculature by active focussing.

4. Conclusion

Facial paralysis is a commonly encountered entity in a dental office and every dentist besides having a basic knowledge about it should also have an understanding and knowledge of Synkinesis that is associated with the disease during its healing phase. However, as is evident from the present case, more studies need to be encouraged to understand the mechanism of symptoms associated with the unaffected side as seen in this case.

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