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Functional Results Evaluation Of Primary Surgical Repair Of Unilateral Cleft Lip By Tennison Technique According To Electromyographic Data

Research Article

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Abstract

Background: Cleft lip and palate is one of the most common congenital malformations that affect patients, quality of life in the long term and require multidisciplinary medical care until adulthood. There are several surgical techniques used to correct a unilateral cleft lip and all of these techniques aim to restore functional and aesthetic aspects toensure the continuation of the normal growth and development of the craniofacial structures. Numerous studies have reported these surgical outcomesaccording to aesthetic criteria. However, there exists alack of knowledge about, is this surgical technique achieved functional aspects. Accordingly, this review aims to answer this question.
Materials and Methods: The study included needle electromyography test for both the Orbicular Muscle of Mouth,Elevator muscle of Upper Lip and Wing of Nose in 10 complete unilateral cleft lip patients aged 2,5-4 years who underwent a primarysurgical repair of the lip at the age of three months with Tennison technique in the department of Oral and Maxillofacial Surgery, Tishreen hospital, Lattakia, Syria.
Results: *The result showed no significant statistical difference in muscle activity values fort he*Orbicular Muscle of Mouth and Elevator muscle of Upper Lip and Wing of Nose in both cleft and noncleft side (P>0.05).
Conclusion: Using of Tennison technique restores the closest anatomical positioning to muscle fibers of studied muscles.

Keywords: Cleft Lip; Electromyography; Muscle Activity; Muscle Fiber; Registration Electrodes.

Introduction

Cleft lip and cleft palate are the most common birth defects of craniofacial development. Up to 7,000 children with cleft are born each year in the United States. that need long rehabilitation between birth and adulthood [1, 2]. Clefts of the lip and/or palate are immediately recognizable disruptions of normal facial structure [3]. Besides dysfunctional facial expressions, problems with sucking,swallowing, breathing, chewing, speaking, hearing, and social integration [4, 5]. Clefting has significant psychological and socioeconomic effects on a patient's quality of life and requires a multidisciplinary team approach if it is to be managed properly [6, 7]. The basic principle in cleft lip surgery is to restore the normal anatomical elements and functional characteristics of the upper lip and this leads to the best functional and aesthetic results, which is a fundamental condition for preventing or minimizing secondary skeletal changes in the midface [8]. Functionally, a cleft lip causes a major deformation of the entire muscular structure surrounding the lip and nose by causing a break in the continuity of muscle fibers, which leads to asymmetric growth of the upper jaw and two wings of the nose [8, 9]. Because of the size of muscular deformity associated with cleft lip and its effects on the facial maxillary complex, it was necessary to evaluate the functions of upper lip muscles after surgical correction using electromyography (EMG). Baumann (1989) identified EMG as a process of recording the activity or electrical activity associated with muscle contraction by Registration electrodes [10]. Electromyography is one of the few diagnostic tools that enable direct and objective assessments of muscle function by detecting their electrical potentials [11, 12].

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Our study aimed toassess the electrical activity of both the Orbicular Muscle of Mouth, Elevator muscle of Upper Lip and Wing of Nosein children surgically treated for unilateral complete cleft lip by Tennison technique.

Materials and Methods

Study Design

At the department of Oral and Maxillofacial Surgery, Tishreen University Hospital10 patients (5girls and 5 boys) aged 2,5 to 4. They were diagnosed with surgically treated for unilateral complete cleft lip by the Tennison technique.No statistical differences were noted between genders. All of the children's parents were informed about the examination procedures and gave their consent to all of the procedures performed.

Inclusion criteria: patient age 2,5-4 years with surgically treated for unilateral complete cleft lip by Tennison technique at 3 months.

Exclusion criteria were the association of the cleft with neuromuscular disturbances, a syndrome, a sequence, or karyotype abnormalities.

Study equipment

Electromyography device: Figure. 1 represents the EMG device located in the neurological clinic at Tishreen University Hospital from the German company Nevus.

Electromyography needle electrode: Figure. 2 represents an EMG needle made of silver/silver chloride (Ag/AgCl), disposable, which is the tool used to capture vital signals expressing muscle activity, to be recorded on the device, then studied and analyzed.

Electromyographic Examination: The EMG test was performed with the patients lying flat on their back. The surface of the patient,s skin was cleaned of impurities and degreased with a 70% ethyl alcohol solution by wiping it several times with disposable cotton wool. A surface local anesthetic was applied to the site where the needle was inserted. Figure 3 shows selecting the muscle that we will perform the EMG test. The EMG activity was recorded by a needle electrodeinserted to the Orbicular Muscle of Mouth, Elevator muscle of Upper Lip and Wing of Nose on the cleft and noncleft side of the lip. the electrode was positioned laterally to the scar tissue present on the upper lip. Each procedure was repeated three times at a rate of five minutes between each of these recordings to avoid any effects of fatigue. we measured on the raw EMG the maximal peak amplitude of the burst of activity (in μV) of the three repetitions on the cleft and noncleft side. The highest value obtained on each side was selected for analysis (figure 4). There were no marked differences in the peak amplitudes among repetitions by a single subject.

Results

Results for the Elevator muscle of Upper Lip and Wing of Nose

Table 1 shows the values of maximal EMG amplitude for the cleft and noncleft side for theElevator muscle of Upper Lip and Wing of Nose. Table 2 shows An analysis of the EMG recordings by Independent T-test showed no statistically significant differences between the bioelectric activity recording for the Elevator muscle of Upper Lip and Wing of Nose on the cleft and noncleft side of the lip (P=0.453).

Table 3 shows the values of maximal EMG amplitude for the cleft and noncleft side for the Orbicular muscle of Mouth. Table 4 shows An analysis of the EMG recordings by Independent Samples T-test showed no statistically significant differences between the bioelectric activity recording for the Elevator muscle of Upper Lip and Wing of Nose on the cleft and noncleft side of the lip (P=0.332).

Figure 1. EMG device from the German company Nevus.

Figure 2. EMG needle made of silver/silver chloride (Ag/AgCl), disposable.

Figure 3. Selecting the muscle that we will perform the EMG test.

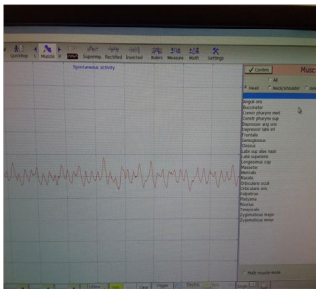

Figure 4. The highest value obtained on each side was selected for analysis.

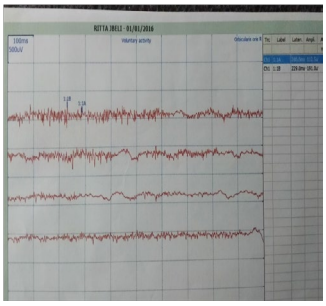

Table 1. Electrical activity (in µV) of Elevator muscle of Upper Lip and Wing of Nose in the children studied.

Group Statistics

Descriptive	N	Mean	Std. Deviation	Std. Error Mean
Noncleft side	10	297.7	132.503	41.901
Cleft side	10	343.9	136.717	43.234

Table 2. Independent Samples T-test comparing Electrical activity (in µV) of Elevator muscle of Upper Lip and Wing of Nose between cleft and noncleft side.

Value	Levene's Test for Equality of Variances		T-test for Equality of Means						
	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
								Lower	Upper
Equal variances assumed	0.041	0.841	-0.767	18	0.453	-46.2	60.207	-172.690	80.290
Equal variances not assumed			-0.767	17.982	0.453	-46.2	60.207	-172.699	80.299

Table 3. Electrical activity (in µV) of Orbicular muscle of Mouth in the children studied.

Descriptive	N	Mean	Std. Deviation	Std. Error
Noncleft side	10	220.2000	56.48363	17.86169
Cleft side	10	245.0000	54.67683	17.29033

Table 4. Independent Samples T-test comparing Electrical activity (in µV) of Orbicular Muscle Of Mouth between cleft and noncleft side.

Value	Levene's Test for Equality of Variances		T-test for Equality of Means						
	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
								Lower	Upper
Equal variances assumed	0.004	0.95	-0.998	18	0.332	-24.8	24.860	-77.028	27.428
Equal variances not assumed			-0.998	17.981	0.332	-24.8	24.860	-77.032	27.432

Discussion

The results of the present study showed no statistically significant differences between the bioelectric activity recording for the Elevator muscle of Upper Lip and Wing of Nose and Orbicular muscle of Mouth on the cleft and noncleft side of the lip in children who underwent a primary surgical repair of the cleft lip at the age of three months with Tennison technique.

A typical sample of patients regularly seen at Tishreen University Hospital was selected for the current study. We take into account age at cleft lip repair, method of repair, surgeon/place of surgery but the presence of a concurrent palatal cleft was not taken into consideration.

As to the EMG recording technique, we were interested in analyzing the activity of a particular lip muscle so we used needle electrodes coupled to systems that permit the computation of integrated EMG. Although surface electrodes have the advantage of being noninvasive and better accepted by patients, the probability of recording separately from a single muscle is extremely low because the signal picked up may reflect not only the underlying muscle activity, but also the amount of connective tissue, the thickness of skin, and action potentials of nearby nerves [13]. These reasons must be taken into account on the differences with other studies.

Many studies involving surface electromyography demonstrated its usefulness as a method of muscle function imaging in patients with congenital abnormalities of the maxillofacial region. Szyszka-Sommerfeld et al., analyzed masticatory muscle activity by means of sEMG in children surgically treated for unilateral complete cleft lip and palate [14]. Surface electromyography also provided the basis for assessing masticatory muscle activity in patients with other congenital maxillofacial anomalies, such as hemifacial microsomia or craniosynostosis [15, 16]. sEMG was used to evaluate masticatory muscle function while monitoring orthodontic therapy in subjects with Down syndrome [17, 18]. Patients with repaired unilateral complete cleft lips and palates have abnormal upper lip function characterized by higher EMG activity of the Orbicular muscle of mouth during functional movements which suggests that the excessive force applied by a repaired cleft lip to underlying structures may affect facial morphology [19].

No papers have been published discussed the use of needle EMG in the evaluation of primary cleft lip repair results. In this context, we tried to highlight the Tennison technique [20] and its effectiveness in restoring normal muscle function according to electromyographic data as many authors pointed out that each of the Orbicular Muscle Of Mouth and the paranasal muscles has a fundamentalrole for the normal development of the upper jaw [21-23].

The study of Genaro et al was conducted on 18 patients 15 to 23 years of age with a repaired unilateral cleft lip. Each had undergone primary lip surgery before 8 months of age. No significant differences in EMG activity for the Orbicular muscle of Mouth were observed between the cleft and noncleft side of the operated upper lip during movement tasks, suggesting that surgical repair eliminated the functional asymmetry reported to be typical of unrepaired cleft lips [24]. which is in accordance with our study results.

Further studies using needle electrodes with a larger sample size would be necessary to evaluate other surgical techniques and other facial muscles in patients with a cleft lip. Furthermore, the correlation between muscular activity and maxillary growth, taking into account different variables, such as the type and severity of the cleft, method of repair, and the timing of the surgical repair.

Conclusion

There was no difference in muscle activity for theOrbicular Muscle of Mouth and Elevator muscle of Upper Lip and Wing of Nose in both cleft and noncleft side in patients with unilateral cleft lip repaired by Tennison technique which indicates that the use of Tennison technique restores the closest anatomical positioning to muscle fibers of studied muscles according to electromyographicdata.

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Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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