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Conservative Management of Ptosis: The Use of Electrical Stimulation

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ABSTRACT
Ptosis means that the upper eyelid droops, usually because of the levator muscle weakness. The purpose of this study was to assess the effect of electrical stimulation (faradism) in the conservative management of ptosis. Nineteen patients with unilateral ptosis were referred from the eye clinic of Murtala Muhammad Specialist Hospital, Kano. Patients were treated wish the use of electrical stimulation (Faradism) for an average of eight weeks treatment duration of five treatment sessions per week (40 treatment sessions). Each treatment session lasted fifteen minutes with an average faradic intensity of 6mA. Levator palpebrae function was assessed using lid excursion before and after treatment duration. Result revealed significant effect at 95.0% C.I of electrical stimulation in the management of ptosis. It was concluded that electrical stimulation is an effective means of non invasive, conservative management of ptosis.

Keywords: Ptosis; Levator palpebrae; Electrical stimulation; Upper eye lid.

INTRODUCTION
Ptosis is dropping of the upper eyelids and is usually due to paralysis of the levator palpebrae superioris or paralysis of the orbital smooth muscle. Paralysis of the levator palpebrae superioris causes complete ptosis and closure of the eye [1-3]. Levator palpebrae superioris arises above and in front of an optic canal. The superficial fibres of the aponeurosis descend through the orbital fat and penetrate the orbital septum to insert among the fascicles of the orbicularis oculi and the skin of the upper eyelid. The middle lamella of the muscle is inserted into the upper boarder of the superior tarsus and consists largely of smooth muscle. The deepest layer of the muscle ends in the superior fornix of the conjuctiva [4/5]. This muscle is innervated by the oculomotar nerve (cranial nerve III). The levator muscle is continuously active (opens the eye by raising the upper lid) during working hours except during closing of the lids. Simple lowering of

the upper lid is accomplished by decrease of levator activity but blinking is the result of contraction of orbicularis oculi muscle [2,6,7].

Clinical presentation of ptosis is complete closure of the eye (paralysis of the levator muscle) or incomplete closure of the eye (paralysis of the smooth ocular muscle). Over-action of the frontal belly of the occipito frontalis muscle which causes wrinkling of the forehead is often associated with a paralysis of the levator muscle [2,8,9]. If the lid droops enough partially cover the pupil, the person attempts to compensate by raising the eyebrow and or by tilting the head back [10,11]. Diplopia becomes evident to the patient when the eyelid is passively raised [9,12].

The cause of the ptosis must first be determined if ptosis is as a result of muscle or nerve disease, treatment will begin by treating the disease first. If tumour is the cause, it can sometimes be removed. In some cases, surgery may be suggested depending on the severity. As with any surgery, there are risks. "Ptosis crutches" are also available; these devices are uncomfortable and usually not well tolerated [13,14].

The use of electrical stimulation in the strengthening and activating weak or paralysed muscles and nerves is well documented [15-18]. Direct stimulation of the levator muscle or oculomotor nerve is not possible due to the fact that superficial access for electrode placement is lacking. By virtue of this, indirect stimulation of this muscle and nerve is possible via the anticipated principle of reciprocal innervation and irradiation of stimulus between the orbicularis oculi and levator palpebrae superioris muscle.

MATERIALS AND METHODS

Design

In this study, a randomized repeated measure design (a pre test, post test Control) order was used.

Subjects

The subjects for this study included 28 (17 males, 11 females) ptosis patients with age range of 12-60 years. The patients were referred to the department of Physiotherapy, Murtala Mohammad Specialist Hospital (MMSH), Kano from Ophthalmology department of the same hospital. All subjects presented with complete unilateral ptosis.

Instruments

Electrical stimulator (Endomed 581 ID) Made in Germany by Siemens; Millimeter ruler.

Pilot Study

A pilot study was conducted using 20 normal subjects aged between 20 and 50 years. The essence of the pilot test was to refine the administrative procedure of the measurement to be used for data collection (levator function - lid excursion measurement). A test re-test method was used; subjects' lid excursion was measured and recorded in millimeters as described by Evans [19], Happer and Fischel [2] and Miller [11]. This procedure was carried out at two weeks interval, using the same subjects. Pearson moment correlation test was used. A reliability coefficient (r) value of 0.967 was obtained.

Data Collection

On arrival to the department subjects were randomly assigned to 2 groups (treatment group and control group) as they reported to the department. Informed consent was sought from subjects willing to participate in accordance with the ethics of human participation by the ethics committee of Murtala Mohammad Specialist Hospital, Kano. Subjects' history, past medical and family social history was taken. Observation and examination was carried out and recorded.

Pre-treatment Procedure

Levator function was assessed by measuring the lid excursion with the aid of a millimetre ruler. The examiner placed the thumb of one hand horizontally over the patient's brow. The patients were directed to look down without moving their heads. With the other hand, the

examiner placed a millimeter rule just in front of the upper lid and notes the reading on the ruler opposite the lid margin. The thumb was later pressed firmly on the eye brow fixing the frontalis muscle. The patients were asked to look up as far as possible without moving their heads. The difference in the two readings is a practical measurement of levator function (lid excursion). Readings on the millimetre ruler were noted and recorded. This procedure was in accordance with the method of Evans [19], Happer and Fischel [2] and Miller [11].

Treatment Procedure

Subjects in the treatment group were placed in a comfortable sitting position. The area to be treated (stimulated) was washed with soap and cleaned with cotton wool. Using Faradism, electrodes were placed as described by Foster and Palastanga [17]. One electrode (the anode) was placed at the region of the temporamandibular joint (sternomastoid foramen) to get the trunk of the facial nerve. The cathode was placed at the motor part of the orbicularis oculi. Subjects were stimulated 5 times per week for a period of eight weeks (40 treatment sessions) at a mean frequency of 6Hz, mean time (duration) of 15 minutes and mean intensity of 6mA per session.
Subjects in the control group were advised to continue their drugs as prescribed by their Ophthalmologists.

Post-treatment Procedure

Following the eight weeks treatment, subjects in both groups were reassessed for levator function (lid excursion) as earlier described. All findings were recorded. Post-treatment levator function (lid excursion) was determined and recorded by a neutral assessor (Physiotherapist) who had no prior knowledge of the pre-treatment scores.

Data Analysis

Mean and standard deviation were computed; 95.0% Confidence interval was used to test for significant difference between pre-treatment and post-treatment levator function (lid excursion) for the experimental and control groups. The statistical analysis was

performed on a microcomputer using the Statistical Package for the Social Sciences (SPSS) (Version 16.0, Chicago, IL, USA).

RESULTS

The age of subjects ranged from 12 to 60 years with mean and standard deviation of 34.79 $\pm$ 15.03 respectively.
Table 1 details the pre and post intervention outcome of lid excursion in both treatment (experimental) and control groups.

Table 1: Pre and post treatment and control lid excursion (N=28)

Variables	n	X	SD
Pre-treatment lid excursion (mm)	19	0.320	0.39
Post-treatment lid excursion (mm)		7.790	0.97
Pre-control lid excursion (mm)	9	0.889	0.39
Post-control lid excursion (mm)		1.111	0.90

Table 1 showed that the mean levator function (lid excursion) increased by a mean of 7.47 mm (SD 0.58 mm) in the treatment group; while in the control group mean lid excursion increased by 0.222 (SD 0.60); that is, lid excursion was greater following intervention in the treatment group.

Table 2 shows the experimental and control group levator function (lid excursion) Confidence Interval (95% C.I).

Table 2: Confidence interval (95% C.I) of experimental and control group levator function (lid excursion) (N=28)

Groups	n	$\bar{d}$	SD	95% C.I
Experimental group lid excursion (mm)	19	-7.263	0.991	-7.740, -6.786*
Control group lid excursion (mm)	9	-0.222	0.442	-0.561, 0.117

$t_{(18)} = 2.101$; $t_{(8)} = 2.306$; * significant

There is a significant ($P<0.05$) difference in pre and post treatment lid excursion in the experimental group, with an increase in the mean value for levator function following intervention. In the control group, there is no significant ($P>0.05$) difference in the lid excursion before and after intervention.

DISCUSSION

The goal of this study was to examine the effect of electrical stimulator in the conservative management of ptosis. This study showed a significant effect of electrical stimulator in the management of ptosis. According to Davson [20], closure of the eyes is brought about by contractions of the orbicularis oculi muscle, associated with a reciprocal inhibition of the levator palpebrae of the upper eyelid. Reciprocal innervation states that when a stretch reflex occurs, the muscles that antagonise the action of the muscle involved (antagonist) relax [21,22]; this in turn facilitate the relaxed (antagonist) muscle for contraction and the cycle continues [23]. In the present situation, the levator muscle is the agonist of upper eyelid opening while the orbicularis oculi closes the eye (antagonist); stimulation of the orbicularis oculi (antagonist) may probably have facilitated the levator muscle.

Another probable means for indirect stimulation of the levator muscle might be due to the fact that there exist irradiation of stimulus. Irradiation of stimulus is the spread of excitatory impulse to more and more motor neurons [21,22]. Since the tendon of the levator palpebrae is inserted among the fascicles of the orbicularis oculi [7,24], there might possibly have been spread of stimulus from the orbicularis oculi to the levator palpebrae superioris muscles.

CONCLUSION

The authors therefore conclude from this study that electrical stimulation (faradism) is effective in the conservative management of ptosis and it can be carefully be applied in clinical practice; however, large sample study may be conducted to further confirm findings of

this study. Furthermore, ophthalmologists need to be made aware on the role of physiotherapists in the conservative management of ptosis.

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