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Tens with Exercise Maneuvers in Dysphagia Rehabilitation

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ABSTRACT:

Aims and Objectives: Dysphagia has been associated with higher rates of respiratory complications and increased risk of aspiration pneumonia, dehydration and nutritional com-promise Therefore the present study was design to find out the efficacy of TENS with exercise maneuvers in the treatment of dysphagia.**Methodology:-** This Experimental study conducted in the Himalayan Hospital, Jollygrant, Dehradun-UK. A sample of 20 subjects was recruited for the study. The subjects were randomly divided into 2 groups, Subjects in Group A were given TENS therapy. The therapy is usually given for 30 min session for 6 days. Following this the subjects were given swallowing therapy for 30 min for same no. of days. Subjects in group B will be given only TENS therapy. Functional oral intake scale (FOIS) was use as Main outcome variable.**Results:** Both the exercise regimes showed improvement in the dysphagia but TENS compared with exercise maneuvers provided a significant improvement in dysphagia rehabilitation compared with the TENS alone.**Conclusions:** TENS with exercise maneuvers should be uses in dysphagia rehabilitation as compared with the TENS alone.

Key Words: Dysphagia, TENS, exercise maneuvers, FOIS score.

Introduction

Dysphagia is a greek word that means disordered eating. Dysphagia typically refers to difficulty in eating as a result of disruption in the swallowing process (Singh & Handy, 2006). Dysphagia is extremely common following a stroke, affecting 13%–94% of acute stroke sufferers, with incidence relating to lesion size and location. Dysphasia has been associated with higher rates of respiratory complications and increased risk of aspiration pneumonia, dehydration and nutritional com-promise. **(**Barbara).

The impulse to swallow begins in the frontal swallowing centre located just in front of the face area of the motor cortex at the foot of the precentral gyrus. Electrical stimulation of this area induces swallowing activity in the striated muscles of the mouth, tongue and pharynx. Axons of these cortical neurons descend through the white matter of the corona radiate and internal capsule, the cerebral peduncle of the midbrain, and the pyramidal tract fibres in the pons. They then cross and project onto motor nerve cells of the medulla oblongata. (Wutichai).

The entire pathway from motor cortex to medulla is called the cortico bulbar tract; a second swallowing centre is located in the medulla. This medullary swallow-ing centre actually comprises at least three separate clusters of nerve cells. First neurons in the vicinity of the nucleus of the tractus solitaries appear to receive sensory inputs related to swallowing from the cranial nerves involved in the sensation

of the oropharynx, the trigeminal (V), glosso-pharengeal (IX), and vagus nerves. This centre also coordinates motor outputs from the nucleus ambigus (the principal motor nucleus for the muscles of the swallowing) and the dorsal motor nucleus of the vagus (X) nerve, which is thought to control the esophageal phase of swallowing. Axons from these motor nuclei travel as a part of the vagus nerve to the muscles of swallowing (Wutichai, Suttipong).

Coordination of swallowing depends on the integrity of sensory pathways from the tongue, mouth, pharynx and larynx (cranial nerves V, VII, IX, X) and coordinated voluntary and reflex contractions involving cranial nerves V, VII, and X-XII[4]. Deglutition is the act of swallowing, which allows a food or liquid bolus to be transported from the mouth to the pharynx and oesophagus, through which it enters the stomach. (Crary, et.al. 2005).

Normal deglutition is a smooth, coordinated process that involves a complex series of voluntary and involuntary neuromuscular con-tractions and typically is divided into distinct phases:1)Oral, (2), pharengeal,(3), esophageal. Each stage facilitates a specific function; if stages are impaired by pathologic condition, specific symp-tom may release. (Leelamanit, 2002).

Abnormalities of the preparatory, oropharyngeal or esopha-geal phases of swallowing are seen in the elderly population and patients with central nervous system diseases or neuromuscular disorders. These individuals often present with dysphagia, choking, coughing, pneum-onia, and malnutrition. (Crary, et.al., 2005; Leelamanit, 2002)

Clearly the goals in dysphagia therapy are to reduce the morbidity and mortality associated with chest infections, improve nutritional status, and return patients to a normal diet with resultant improvement of their quality of life unfortunately; there is a paucity of evidence for dysphagia therapy.(Lazarus, 1993).

There are currently two primary theories as to how TENS may facilitate muscle function, based upon earlier physical medicine literature and applications to sports physiology. One theory suggests that muscle strength is facilitated in a fashion similar to that of voluntary exercise. Therefore, these TENS protocols would involve programs of low repetitions with high external loads and high muscle contraction intensity.(Ludlow, 2007)

A second theory is based upon muscle recruitment patterns. TENS is believed to selectively recruit type II muscle fibers first (a pattern that is opposite that of normal muscle recruitment). Type II fibers produce a higher force contraction than that of type I, slow-twitch muscle fibers. (Beom J, 2011).

Rehabilitation exercises such as postural adjustment, shakers exercise, the Mendelsohn maneuver, and effortful swallowing typically do not recruit type II muscle fibers unless vigorous exercise requires their utilization. Thus, a modality such as TENS favoring recruitment of type II fibers may produce greater gains in muscle strength than exercise alone (Gallas S, 2010; Lake, D. A. 1992).

This study aims to treat dysphagia via TENS and to determine the effectiveness of tens with exercise maneu-vers in treating dysphagia. The idea of utilizing TENS to facilitate swallow function is relatively recent. To some, the interest in application of TENS to the muscles involved in swallowing seems to have a rational basis. However, the mechanism(s) underlying physiologic changes that may occur following TENS is unclear.

Methodology-

This Experimental study was conducted in the Himalayan Hospital, Jollygrant, Dehradun-UK. A sample of 20 subjects was recruited for the 50 subjects as population on the bases of inclusion &

exclusion criteria. **Inclusion criteria:** Acute dysphagia less than 1 month. Dysphagia following Stroke, Traumatic head injury, Any cevical trauma, Degenerative diseases such as Parkinsonism , Amytrophic lateral sclerosis, GCS score of 11-15 with normal eye and motor responses and verbal varying from 1 to 5, Both genders. **Exclusion criteria:** Difficulty in swallowing prior to the incidence of neurological disorder, Dysphagia due to structural and anatomical abnorm-alities, Aphasia, Uncoperative patients,Subjects with pacemakers, metal implants or orthotics, Skin breakdown Cardiac or seizure disorders, Pregnancy , Head and neck cancer.

Procedure :-The subjects were randomly divided into 2 groups.

Subjects in Group A were given TENS therapy. The therapy involves the application of electric stimulation. First electrode is placed over the hyoid bone, second is placed just below the first one, above the thyroid notch, 3 and 4 electrode placed at equal distances form first two electrodes. Electric pulses are then delivered continuously at 80Hz for pulse duration of 300 μs and intensity ranging from 2.5 to 25 mA depending on the patient's tolerance. The patient is encouraged to repeatedly swallow hard using endogenous saliva. With progress, the patient is upgraded to swallow solid foods during the protocol. The therapy is usually given for 30 min session for 6 days. Following this the subjects were given swallowing therapy for 30 min which will include (Lim, K.B., 2009; Shaker, R. & et.al., 2002; Lazarus C & et.al., 1993).

1) Diet modification.

2) Head and neck positioning

3) Effortful swallowing

4) Mendelsohn maneuver

5) Shakers exercise

Subjects in group B will be given only TENS therapy with the same procedure as in Group A.

Instrumentation: TENS machine, four electrodes, leucopore, Tea spoon, Bowl Food thickner, Juice.

Outcome measures

Functional oral intake scale (FOIS) (Shaker R & et.al., 2002).

- Level 1- Nothing by mouth
- Level 2- Tube dependent with minimal attempts of food or liquid
- Level 3- Tube dependent with consistent oral intake of food or liquid
- Level 4- Total oral diet of a single consistency
- Level 5- Total oral diet with multiple consistencies but requiring special preparation or compensations
- Level 6 -oral diet with multiple consistencies without special preparation, but with specific food limitations
- Level 7- Total oral diet with no restrictions

Fig: 1 TENS electrodes applied to neck region

Fig2: Patient performing exercise

Data Analysis: Results were analysis by using value $p \leq 0.05$as level of significance. Paired and un-paired t-test was used to analyze and compare the score within groups and between groups respectively. The initial FOIS score and score after 6day of therapy were compared within and between the groups.

Results: Results describe that there are significant changes in FOIS score within Group A and Group B.On comparing both the Groups the results were significant and FOIS score is better in GroupA. Hence, Experimental Hypothesis is accepted.

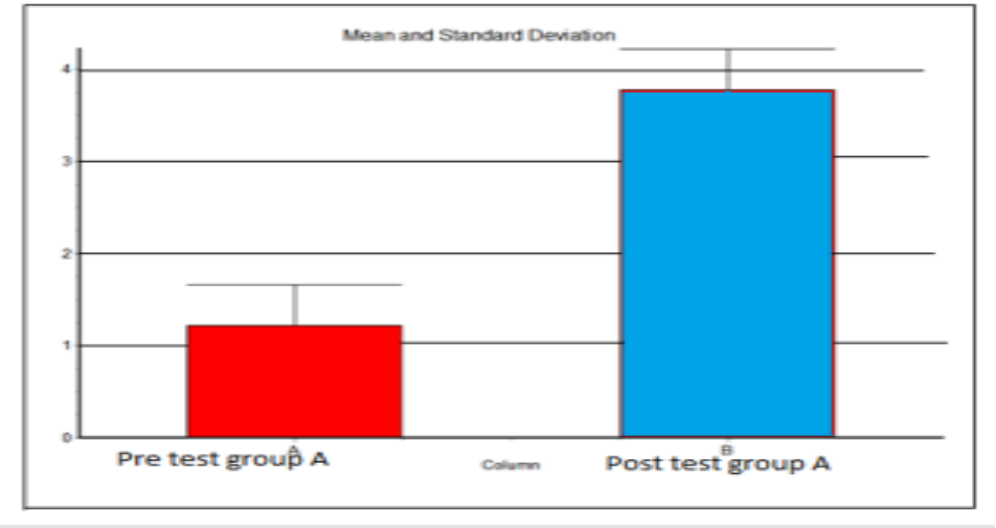

Fig. 3: Comparison of mean and standard deviation of FOIS score in Group A.

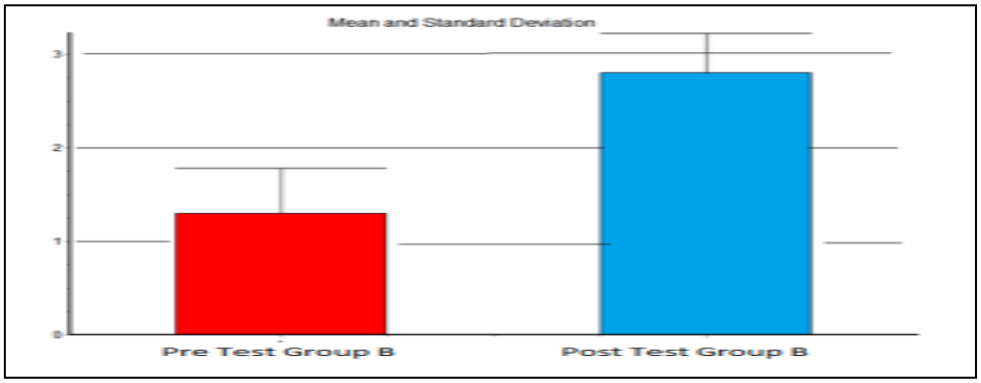

Fig. 4: Comparison of mean and standard deviation of FOIS score Group B.

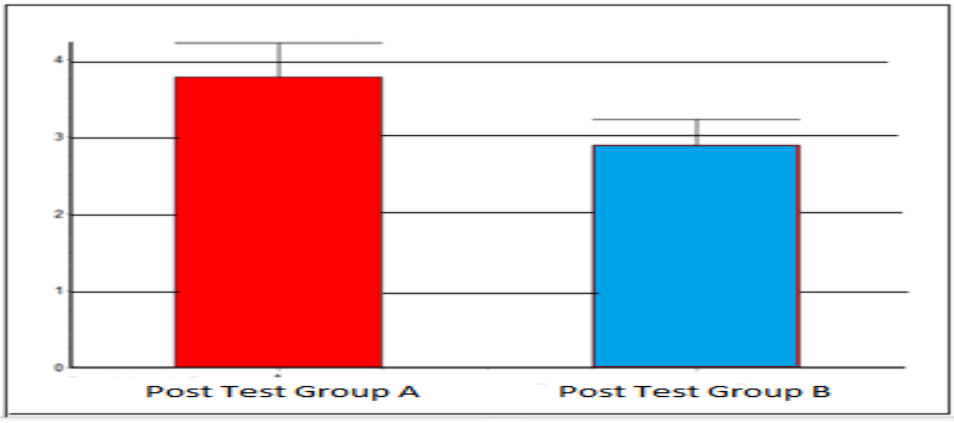

Fig. 5: Comparison of mean and standard deviation of FOIS score at Post Treatment Group A and Post Treatment Group B.

Table1:- Comparison of M ±SD between group A and group B by FOIS score at post treatment seventh day.

Groups	M ±SD	T Value	P Value
Group-A	3.778±0.147	4.824	0.002
Group-B	2.889±0.333		

Discussion: Dysphasia affects up to half of acute stroke patients and carries a threefold to sevenfold increased risk of aspiration pneumonia. With the subsequent mortality associated with pneumonia, dysphagia has been recognized as an independent predictor of mortality after stroke. The treatment usually incorporated in the dysphasia is feeding via a percutaneous endoscopic gastronomy tube or a nasogastric tube. However the tube feeding should not be seen as an end point in dysphagia rehabilitation as mortality rate has been found to be as high as 50 %, due to high incidence of pneumonia in tube fed patients and tube feeding cannot be considered as a permanent treatment of dysphagia as it is just an alternative treatment. (Suiter & et.al., 2006).

The results of this study reveal a significant change between the pre and post treatment in the FOIS score for Group A. The results have been supported by the study done by Jin-Woo Park, Oh, Lee, et al (2009) because they believed that the training of effortful swallow in conjunction with electrical stimulation would increase the degree of hyoid elevation in healthy individuals.(Park, J.W & et.al., 2009).

The results have been proved by the study done by Steele CM et al 2009 that Transcutaneous neuromuscular electrical stimulation is used on innervated muscle to recruit motor units, improve muscle contractions, especially type II muscle fibers, and increase muscle strength. TENS is believed to selectively recruit type II muscle fibers first (a pattern that is opposite that of normal muscle recruitment). Type II fibers produce a higher force contraction than that of type I, slow-twitch muscle fibers. (Steele, C.M & et.al., 2007).

They have also proved in their study that use of exercise maneuvers also brings significant improvement in treating dysphagia. The common chin tuck entails asking patients to lower their chin towards their chest before swallowing, which brings the epiglottis and the aryepiglottic folds closer to together, allowing the opposition of these structures to close the airway during swallowing. The head turn is a simple rotation of the head to the paretic side in an attempt to increase bolus flow. (Suiter, D.M & et.al., 2006).

Study done by shaker R et al in 2002 proved that The shakers exercise also shows significant improvement in the UES opening, anterior laryngeal excursion, The Mendelsohn maneuver requires a little more training and entails the sustained contraction of the suprahyoid muscles in an effort to maintain laryngeal elevation and thus upper esophageal sphincter opening and airway closure. (Lake, D. A., 1992; Shaker R. & et.al., 2002).

The results of this study reveal a significant change between the pre and post treatment in the FOIS score for Group B .This shows that TENS alone is also effective.

Trascutaneous electrical neuromuscular stimulation (TENS) has recently been proposed as a treatment option for pharyngeal dysphagia. Surface electrical stimulation is applied through electrodes placed on the neck with the goal of promoting increased hyoid or laryngeal elevation. TENScan actually stimulate the deep strap muscles of the head and neck, it could benefit treated head and neck problems patients who experience reduced laryngeal elevation. Because TENS is intended to improve hyolaryngeal elevation, it can be considered a ROM exercise.(Lazarus C, 1993)

TENS for dysphagia has become a widely utilized clinical procedure. Freed MLet al, Shaw GY et al. reported success rates after treatment with surface NMES range from 40% for patients with severe dysphagia to 98% in patients with dysphagia after stroke. Significant improvements also have been reported in swallow function in a long-term acute care setting. (Freed, M.L & et.al., 2001); Shaw, G.Y & et.al., 2007).

Blumenfeld, L., Hahn 2006, et has supported the finding of this study by showing the significant of TENS treatment in improvement of dysphasia. Low repetitions with high external loads and high muscle contraction intensity TENS protocols sows significance results.A second theory is based upon muscle recruitment patterns. However, critics of the technique have proposed that TENS may actually elicit physical actions antagonistic to those needed for swallowing. When electrodes are placed in the sub mental region, the current density is greatest at the surface of the skin and diminishes with depth as it travels through the skin, subcutaneous fat, and platysma muscle. (Blumenfeld ,L, 2006).

There are different significant effects of using TENS and exercises separately. So results of our study emphasis the use of combination therapy in treating dysphasia. Kiger et al suggested that rehabilitation exercises typically do not recruit type II muscle fibers unless vigorous exercise requires their utilization. So combination of TENS & Exercise maneuvers results in early transition from tube feeding to the oral feeding. Hence these techniques should be incorporated in the treatment protocol of patients with dysphagia in the acute stages of diseases.(Kiger, M., & et.al., 2006; Crary, M.A., 2007).

Conclusion: The present study concludes that the TENS combined with exercise maneuvers (Group A) and TENS (Group B), both have significant effect in treatment of dysphagia.So combination of TENS & exercise maneuvers therapy are more effective in reduction of dyshagia.

Clinical relevance: Dysphagia causes disability in a wide range of acute and chronic neurological diseases. Dysphagia profoundly influences quality of life. For those patients who fail to recover a safe swallow in the short term, the alternative is enteral feeding via a percutaneous endoscopic gastrotomy tube or nasogastric tube. However, tube feeding have shown a high incidence of pneumonia and a high mortality rate.

The present study has found that the use of physical therapy techniques in treating patients with dysphagia is effective, TENS compared with exercise maneuvers being more effective than only TENS.

Future research:

The further studies should be explored for the best location for electrode adhesion, effects of varying frequencies and duration of each session, and total number of sessions in dysphasia rehabilitation.

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