RESEARCH ARTICLE

Effect of Early Physiotherapy for Endotracheal Intubation-induced Temporomandibular Joint Dysfunction: An Experimental Study

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Abstract

Aims and objectives: To determine the effect of early physiotherapy in endotracheal intubation-induced temporomandibular joint dysfunction (TMD) and to compare the effect of early physiotherapy interventions and conventional treatment (CT) in TMD in endotracheal extubated patients.

Meterials and methods: An experimental study was carried out in 40 endotracheal extubated (ETE) subjects diagnosed with TMD. The subjects were randomly allocated to group I as an experimental group receiving early physiotherapy and group II as a conventional group receiving routine treatment for 14 days. The outcome measures were used the American Academy of Orofacial Pain (AAOP) Questionnaire, visual Analog scale (VAS), physical assessment tool, range of motion (ROM) of TMJ, tenderness over orofacial muscles.

Results: The results obtained show that both the groups showed significant improvement in the outcome variables and therefore aids with early correction of dysfunction. Within group analysis showed statistically more significant improvement in all outcome measures for group I. VAS ($p < 0.0001$), ROM for all four motions ($p < 0.0001$), auscultation test = 95% improvement, provocation test = 95% improvement, tenderness = 95%. However only, AAOP questionnaire was not significant for group II (p value > 0.001).

Conclusion: We found that those early physiotherapy interventions showed significant improvement in the outcome variables concluding that it improves TMJ mobility and reduces pain. It can be further concluded that conventional treatment can be more efficacious if combined with early physiotherapy interventions.

Keywords: Endotracheal intubation, Orofacial pain, Physiotherapy, Temporomandibular joint dysfunction.

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Introduction

Temporomandibular dysfunction (TMD) is a group of orofacial disorders affecting temporomandibular joint (TMJ) and its associated structures.[1] TMD has multifactorial etiologies.[2] One of the etiological factors suggested as contributing to TMD is microtrauma, including forceful intubation.[3]

In emergency settings, sometimes endotracheal intubation (ETI) is performed by resident doctors and nurses. An ETI-induced microtrauma has been proved a predisposing factor for TMD in a few published case reports and systematic review articles. During this maneuver, anesthesiologist attempts rotation and translation of the TMJ. ETI in the ICU is a potentially hazardous procedure, most commonly due to failing oxygenation and unstable hemodynamics during emergency intubations.[4] During this technique, harm may occur to the TMJ apparatus due to greater forces being applied either with a laryngoscope or manually in the process of completion of intubation. Complications noted in the cited case reports and studies include brief or permanent jaw locking, disc dislocation, muscle pain, and facial pain.[3] Though little studied, the deleterious effect of ETI on TMJ dysfunction is largely established.[3] Difficult Airway Society guidelines states 5–10% prevalence of TMD post-extubation.

Noninvasive managements prove to be the first option for 85–90% of TMD patients.[5] Systematic reviews and meta-analysis produce evidence that physiotherapy interventions are more beneficial than other treatment modalities in the management of TMD for pain reduction and improving ROM. Large-scale superior quality experimental studies with a standard management protocol are desired to establish whether physiotherapy is actual and has potent therapeutic value in the management of TMD. However, there are no studies that reported interventions with early physiotherapy intervention (EPI) for ETI-induced TMD.[5]

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Conflict of interest: None

Materials and Methods

After approval of the Institutional Ethics Committee, this experimental study was conducted in Krishna Hospital, Karad. The primary objective of this study was the effect of early physiotherapy interventions on temporomandibular joint dysfunction in ETE patients. The samples were 40 ETE patients in which ETI was done by resident doctors and nurses. Both genders, age 20–50 years,

diagnosed with TMD in a screening session were included, in the study. It was using the AAOP questionnaire and a detailed physical assessment. According to the inclusion criteria, ETE, who were intubated after abdominal surgery, cardiac surgeries, and airway diseases (ARDS and pneumonia) were selected. No specific duration of ETI was taken into consideration. In all selected samples, ETI duration was ranged between 3 days and 15 days. Patients with head neck surgeries, neurological surgeries, tracheostomy, and laryngeal masks were excluded. The patients who showed maximum positive responses for the assessment were selected. ETE patients having TMD deficits on screening were randomly allocated by using random allocation software into two groups. Group I was experimental, and group II was conventional. Both group I and group II had 20 subjects each. Group I received a set interventional treatment protocol for 14 days. Group II was given CT including routine chest physiotherapy, medical, and nursing care. Both the groups received physiotherapy under the observation of concern intensive care and ward physician. Between groups, comparison was done by applying the "UnPaired *t* test" to pre- and posttreatment values of both groups for all outcome measures (Tables 1 and 2).

Table 1: Sociodemographic data of the subjects (endotracheal extubated patients) participated in the study ($n = 40$)

Variables	*Frequency (n)*	*Percentage*
Gender		
Female	30	75
Male	10	25
Variables	Group I (mean)	Group II (mean)
Age		
21–30	26.25 (2)	25.50 (2)
31–40	33.55 (4)	34.55 (3)
41–50	41.40 (4)	40.60 (5)
Illness		
OP poising	5	4
Pneumonia	7	8
Abdominal S.	3	4
Bronchitis	3	2
ARDS	2	2
Type of intubation	Frequency	Percentage
Elective	10	75
Emergency	30	25

Group I: Early Physiotherapy Intervention[5–10]

Table 2: Early physiotherapy intervention protocol

Group I[5–9] Early physiotherapy intervention	
A. Maximum protection phase: (0–7 days)	
Aim: pain management	
Day 1	• Patient and relative education[5] • Diaphragmatic breathing program[5]
Day 2–3	• Kinesiotape V-shape extended to inferior border of jaw muscles and to anterolateral aspect of neck[8]
Contd...	
	• Cryotherapy Crushed ice wrapped in towel. Circular pattern 2–4 times a day. Maximum 8 times to minimum once a day. 10–15 minutes ideal duration[7]
	• Soft tissue techniques: Extraoral massage: Intraoral trigger point release[6]
Day 4–5	• Patient education (tentative removal of ryles tube)[5]
	• Electrophysiological modalities:[10] Ultrasound: Dosage: continuous at a frequency of 1 MHz and intensity of 1.0–1.25 W/cm for 3 minutes over TMJ[8]
	• Soft tissue mobilization For temporalis, masseter, medial pterygoids, and lateral pterygoids muscles. Can be done using one digit or multiple digits to contact myofascial trigger points. Can be applied unilaterally or bilaterally[6]
Day 6–7	• Control of jaw muscles and joint proprioception: Recognition of resting position of the jaw Teach controlled opening and closing of jaw Mirror for reinforcement[7]
	• Stretching techniques: Passive stretching: placing layered tongue depressors between central incisors, and then gradually work to increase the amount of layers far enough to insert the knuckles of index and middle fingers[8]
B. Moderate protection phase (8–10 days)	
Aim: to increase restricted range of motion	
Day 8–10	• Joint manipulation techniques Unilateral distractions Bilateral distractions Anterior glide Medial and lateral glide Dosage: 1–3 sets of 10 reps[6]
	• Active exercise program Tongue position at rest Teeth apart Nasal-diaphragmatic breathing Tongue up and wiggle Strengthening Touch and bite (proprioceptive re-education) Neuromuscular control Isometric exercises[5]
C. Minimum protection phase (11–14 days)	
Aim: strengthening	
Day 11–14	• Resistive exercises[7]
	• Proprioceptive neuromuscular facilitation[7]

Group II: Conventional Treatment[5]

Medical, nursing care, and chest physiotherapy.

Results

A total of 100 ETE patients fulfilling the inclusion criteria were screened by anesthetists and physiotherapist. To be diagnosed

with TMD, 52 patients were found. Out of which six did not agree to participate, four on discharge terminated the treatment, and two had severe complications. Remaining patients were found majorly to present with at least one sign or symptom of TMD. The patients who showed maximum positive responses for the assessment were selected (Tables 3 to 6).

Between the Group Comparison

AAOP Questionnaire (Between the Group)

Interpretation: Figure 1 shows the comparison between the groups. The graph shows difference in the post-training values between the groups. AAOP questionnaire showed a significant association between pre- and posttreatment answers in both groups. Association between pre- and post-signs and symptoms of TMD in group I = *p* value <0.0001 proved statistically significant. Group II = *p* value >0.0001 proved statistically nonsignificant.

Visual Analog Scale (On Activity)

Table 3: Between the group comparison-VAS (on activity) according to the *p* values

Group	*Group I*	*Group II*	*t value*	*p value*	*Significant*
Pre-training	3.35 ± 1.46	3.50 ± 1.27	0.345	0.731	Not significant
Post-training	0.80 ± 0.83	1.95 ± 1.19	3.538	0.0011	Very significant

TMJ Goniometry

Table 4: Between the group comparison-goniometric measurements

Parameters (Pre)	*t value*	*p value*	*Remarks*
Mouth opening	1.04	0.305	Not significant
Left lateral movement	0.558	0.305	Not significant
Right lateral movement	0.941	0.352	Not significant
Protrusion	1.83	0.073	Not significant

Parameters (Post)	*t value*	*p value*	*Remarks*
Mouth opening	6.35	0.093	Significant
Left lateral movement	4.28	0.093	Significant
Right lateral movement	4.76	0.481	Significant
Protrusion	7.88	0.628	Significant

Parameter (Post)	*Group I*	*Group II*
Mouth opening	41.5 ± 3.3	34.8 ± 3.36
Left lateral movement	8.9 ± 0.64	7.8 ± 0.95
Right lateral movement	8.45 ± 0.75	7.2 ± 0.89
Protrusion	6.95 ± 0.51	8.3 ± 0.57

Auscultation and Provocation Test

Table 5: Between the group comparison-special tests

	Group I		*Group II*	
	Post		*Post*	
	Yes	*No*	*Yes*	*No*
Auscultation T.	19	1	16	4
Provocation T.	19	1	15	5

Tenderness

Table 6: Between the group comparison-tenderness in different muscle groups

	Post		*Post*	
	Yes	*No*	*Yes*	*No*
Temporalis	1	19	5	15
Masseter	1	19	8	12
Medial pterygoids	1	19	9	11
Lateral pterygoids	1	19	16	4

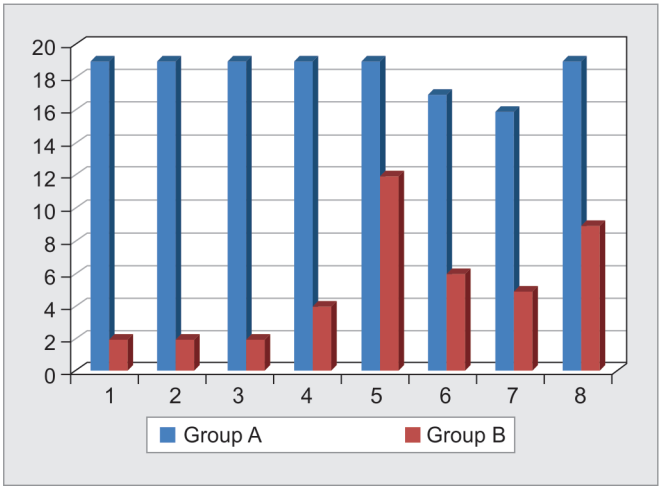

Fig. 1: Between group comparison of AAOP questionnaire

Physical assessment, which includes VAS, tenderness, auscultation and provocation tests, also showed similar results. Goniometric measurements showed significant improvement in both. Mouth opening was the most improved parameter noted in group I with a mean value of 41.4 mm. VAS showed statistically significant improvement with a reduction in pain levels with *p* value <0.001. Group I showed a reduction in pain with a mean value of 3.35 ± 1.46 to 0.80 ± 0.83. Group II showed a reduction in pain levels with a mean value of 3.50 ± 1.27 to 1.95 ± 1.19. Auscultation and provocation tests showed improvements in both groups. Group I showed significant results in both with 95% improvement. Group II showed relatively less improvement with 80% and 75%, respectively. Group I showed 95% improvement in tenderness reduction in all muscle groups. The results for

group II were 75%, 60%, 55%, and 20% improvement in tenderness at masseter, temporalis, medial, and lateral pterygoids, respectively.

Discussion

In general, the major goal of this study was to correct ETI-induced TMD by improving functional TMJ mobility and relief of pain. Both groups were effective in correction of TMD and EPI proved more efficacious. In the present study, it was found that the majority of subjects experienced pain and tenderness. Also, the present study signifies that ROM, pain, and tenderness showed combined improvement, which interprets the fact that muscle hyperactivity might because of dysfunction postextubation. In course of treatment, patients experienced a significant reduction in intensity of pain in both groups. In a previous study by David Smekal, it was found that the occurrence of TMD is common with stomatological treatment in which the mouth is in a widened position. The same study concluded early treatment not only corrects disturbances but helps prevents further worsening and chronicity. Previous studies propose ETI as a risk factor for TMD. Previous studies state in individuals with a report of prior symptoms, there is an increased reporting of symptoms, which continues for as long as two weeks postoperatively.[3]

Female gender (75%), increasing age (50%), and emergency ETI (75%) are predisposing factors for transient TMD pain following ETI. In a case report, Martin found similar predisposing factors for the occurrence of TMD postextubation.[3] In a study by Battistella, muscle-related conditions encompass the largest subtype among various disorders grouped under TMD.[5] Presence of masticatory muscle tenderness is found to be more in age group of 31 years to 50 years and more among females. The most frequent trigger points were found in temporalis, followed by masseter, medial, and lateral pterygoids. Considering the critical condition of the patients after surgery, the AAOP questionnaire proved to be more feasible. More affirmative answers were found for questions 4–7 for both groups, which support the results of myogenic subtype been more prevalent owing to the nature of the questions.[3] Question 4 resulted in positive findings, regarding presence of joint noises. Statistically, significant improvement was noted in reduction of sounds in both groups with 95% and 80%, respectively. Limitation of mouth opening on pretreatment was found in both groups (<30 mm). In previous studies, a limited mouth opening of <40 mm was noted. The smaller improvements in group II can be attributed to findings in previous study, interincisal distance assessment was related to pain at 7 days, but association at 14 days was not significant.[3]

Treatment protocol was in various phases and used a symptom-specific approach, which is lacking in group II, which might be a responsible factor for a more marked improvement in group I. Additionally, there is no published study that specifically focuses on treating TMD with EPI alone in ETE patients. Also, some studies state using more treatment modalities simultaneously proves more efficacious. Clinical profits of physiotherapy management are widely described both in literature and TMD textbooks. Although, it is generally believed that these treatments are effective in reducing pain and restricted function, with a short-term efficacy, any physiotherapy treatment is better than no treatment. In last few years, several studies have demonstrated different results regarding the effect of physiotherapy treatments in the management of TMD. Early physiotherapy interventions are a valuable treatment option. Treatments that are easily accessible, low cost-effective, and reversible should be given priority.[11] Evidence for application of carefully controlled therapeutic exercise programs for chronic joint disorders like rheumatoid arthritis is also well established.[12] However, only a few studies have investigated its effectiveness for treating dysfunction poststomatological treatments. Additionally, there is no published study that specifically focuses on treating TMD with early physiotherapy interventions alone in ETE patients. This study has addressed this gap of knowledge and has contributed to the evidence that early physiotherapy interventions may also be an additional asset for improving dysfunction in ETE patients.

This study has some limitations. In particular, some limitations are due to the small sample size. Moreover, future studies should evaluate a longer follow-up time and also compare the study value in different stomatological treatments (molar tooth extractions, orthodontic interventions, and dental implants). Furthermore, we also suggest the addition of supplementary interventional methods to get more comprehensive knowledge and improve the efficacy level of the study.

Conclusion

We found that EPI showed significant improvement in TMJ mobility and orofacial pain relief.

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