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Telerehabilitation of Temporomandibular Dysfunction Syndrome during the COVID-19 Pandemic: A Pilot Study

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ABSTRACT

Purpose: To evaluate the efficacy of telerehabilitation presented in a well-designed home exercise program on the manifestation of refractory TMD during the lockdown period of the current COVID-19.

Material and Method: Twenty Adult subjects with TMD were included in this pilot study. After a full medical history taking and clinical examination of the TMJ, the pain level was assessed by a visual analog scale of 100. Assessment of the severity of TMD was done using Fonseca's questionnaire.

Results: The age of our patients ranged between 15-58 years old, with female predominance (55%). On using paired t-test and Wilcoxon Signed Ranks test, very high statistically significant differences (P=0.001) were found between the results of pain at rest and with movement, the distance of mouth opening, and severity of TMD before and after the rehabilitation program. Spearman's correlation test showed a weak inverse significant correlation (P= 0.032) between TMD duration and pain at rest difference. **Conclusion:** This pilot study showed that, during the containment period of the COVID-19 pandemic, telerehabilitation of chronic refractory TMD with no internal derangement, in the form of a home-based well-chosen exercise program with the motivating follow-up of the patients through phone calls and other smartphone applications, were effective in reducing the pain both at rest and with movement, improving the range of motion and the severity of TMD manifestations.

Keywords: Telerehabilitation, Temporomandibular disorder, home exercise program, COVID-

INTRODUCTION

Temporomandibular joint dysfunction/Disorder (TMD) is characterized by pain in the joint itself that radiates into the mandible, ear, neck, and tonsillar pillars[(1)]. The prevalence of TMD was stated to range from 25% to 75% of the population and was reported to be the second musculoskeletal condition causing pain after low back[(2)].

It is of multifactorial etiology including muscle hyperactivity, malocclusion, and emotional stresses[(3)]. Pain and disability are the main drive of the patient to seek medical advice[(4)]. Temporomandibular joint (TMJ) dysfunction can be treated conservatively using medications, and a rehabilitation program or surgically through arthrocentesis, injection, arthroscopy, partial condylotomy, or open joint surgery. The effectiveness of the multidisciplinary approach has been affirmed and conservative treatment can relieve pain and improve function in up to 90% of TMD patients[(5)].

During the lockdown period of the COVID-19 pandemic, the term telerehabilitation has been widely used as an advisable method to deliver rehabilitation care for patients in case of their inability to reach the rehabilitation institute for any reason. The best situation when telerehabilitation can be applied is during infectious pandemics like the one we are passing through these days.

For the sake of our patient's safety, and following the international recommendation of confining and social distancing, this pilot study aimed to investigate the effectiveness of telerehabilitation in the form of a home-based exercise program in improving the manifestations of chronic refractory TMD.

AIM OF THE STUDY

To investigate the effectiveness of a well-designed home-based exercise program applied as a telerehabilitation method for reducing pain and improving the function of temporomandibular dysfunction pain syndrome refractory to medical treatment during the containment period of the COVID-19 pandemic.

METHODS

Study design: A pilot clinical prospective study.

Inclusion criteria: Twenty adult subjects with painful TMJ were included in this pilot study in March 2020. All patients were referred by an expert maxillofacial surgeon to the Rheumatology and Rehabilitation outpatient clinics after establishing the diagnosis and excluding any intra-articular derangement by panoramic x-ray and MRI on the painful TMJ. None of our patients had any manifestation suggestive of COVID-19 infection.

Inclusion criteria were adult patients who were diagnosed to have chronic TMD refractory to pharmacological treatment including muscle relaxants and nonsteroidal anti-inflammatory medications (NSAIDS). Patients with a history of facial trauma or surgery and patients with rheumatic diseases were excluded.

Ethical consideration:

The protocol was approved by the Ethics Review Board of the Faculty of Medicine, Assiut University (identification number 17300389), and according to the Declaration of Helsinki. It was registered at clinical trials with identification number

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NCT04374682. Written informed consent was obtained from each participant before enrollment.

Process: Each subject was evaluated by the rheumatologists with a full medical history including parafunctional habits like gum chewing, nail-biting, and bruxism. Clinical Examination of the TMJ included localized tenderness and range of motion of the mandible. The linear distance between the incisal edges of the central incisors of the upper and lower jaws was measured in the nearest millimeter by the same measuring ruler in all patients[6]. Pain level was assessed by visual analog scale 100 (VAS), both at rest and during TMJ movement[7]. Laboratory work-up included Complete blood count, Erythrocyte sedimentation rate (ESR), and liver and renal function tests.

Assessment of the severity of temporomandibular joint (TMJ) affection was done using Fonseca's questionnaire[8]. For suitable data analysis, the clinical index classification of Fonseca's questionnaire was used[9,10]. Fonseca's questionnaire is composed of 10 questions, which include checking for the presence of pain in the temporomandibular joint, head, back of the neck, and while chewing, parafunctional habits, movement limitations, joint clicking, perception of malocclusion, and sensation of emotional stress. For analysis, the answers "yes", "no" and "sometimes" from each questionnaire were given scores of ten, zero, and, five respectively. A higher score indicates a worse condition.

Then, a motivating single physical therapy session was prescribed to the patients in the form of Therapeutic ultrasound: 0.8-1.0 Watt/cm2 for 3 minutes on the affected TMJ. Transcutaneous Electric Nerve Stimulation (TENS): High-frequency current (>50 HZ) for 10 minutes followed by Low-frequency current (<10 HZ) for another 20 minutes on the TMJ area. The intensity is adjusted according to the patient's tolerance, Friction massage to the TMJ musculature for 5 minutes. After this motivating session, each patient was given an education session by the rheumatologist. It included giving information about the nature of the condition and self-care instructions, and then the exercises were taught to each patient before giving him/her demonstrating pictures of the home exercises. Home-based exercises were as follows: lateral deviation, protrusion/retraction, and mandibular opening. These exercises were done in different body postures: opening and closing of the mouth while the patient is erect, protrusion and retraction in the supine and prone position, and lateral deviation in an alternate side lying position. The patient was instructed to maintain the position of each movement for 10 seconds and relax for another 10 seconds. Each exercise was done as a set of 10 repetitions. Isometric cervical muscle strengthening exercises were also prescribed. Follow-up of their commitments and progress was done every month through one or more of the following methods; Short Message Service (SMS), phone calls, and what's app smartphone calls depending on the feasibility.

Assessment of pain at rest, pain with movement, the distance of mouth opening, and severity of TMD using the Fonseca's scale was done in the hospital twice; once at the entry point to the study and the second after 3 months (the end point of the study).

Statistical analysis

The data were coded and entered using the statistical package for the social science program (SPSS), IBM Corporation, version 20. Data were summarized using descriptive statistics: mean ± standard deviation (±SD), or frequencies (n) and percentages (%). The difference in the mean of clinical parameters (pain at rest, pain during movement, Fonseca's scale, and mouth opening) before and after the Rehabilitation program, between both genders and between unilateral & bilateral joint affection was compared by paired t-test, student t-test & Mann Whitney test respectively. Spearman's correlation test was used to assess the correlation of TMJD duration with different clinical parameters ($P > 0.05$ non-significant, $P < 0.05$ significant, $P < 0.01$ moderate significant, and $P < 0.001$ highly significant)

RESULTS

Twenty subjects complaining of idiopathic (temporomandibular joint disorder) TMJD were recruited in this study. Their age ranged between 15-58 years old, with female predominance (55%). Half of the patients suffered unilateral TMJ pain. Joint pain duration ranged between 15 days to 10 months. Fifty-five percent of participants underwent dental procedures in the last 6 months before complaining, 25% suffered bruxism, while 20% and 15% had the habit of nail biting and gum chewing respectively. Concomitant neck pain was found in 50% of the patients (**Table 1**).

Table 1: Basic demographic and clinical data of the studied patients

	Patients (No=20)
Age in years Mean± SD (range)	35.45±13.57 (15-58)
Gender No. (%)	
Males	9 (45%)
Females	11 (55%)
Side of joint pain No. (%)	
Unilateral	10 (50%)
Bilateral	10 (50%)
Duration of pain in months Mean± SD (range)	2.58±2.28 (0.5-10.0)
Dental procedures within the last 6 months	11 (55%)
Parafunctional Habits	
Gum chewing	3 (15%)
Nail biting	4 (20%)
Bruxism	5 (25%)
Concomitant Neck pain	10 (50%)

No: number, SD: standard deviation

On evaluating the mean of each of the following: pain at rest, the distances of mouth opening, and the Fonseca's scale before and after the designed rehabilitation program using paired t-test, as well as the mean of pain during movement before and after rehabilitation using Wilcoxon Signed Ranks test, very high statistical significant differences were found (**Table 2**).

Table 2: Difference among clinical parameters of idiopathic TMJD before and after the rehabilitation program

Clinical parameter	Before rehabilitation (initial examination)	After rehabilitation (at 3 months)	P-value
PR (mean ± SD) VAS	3.80±2.49	0.70 ± 0 .92	<0.001***
PM (mean ± SD) VAS #	7.00 ± 1.84	2.50 ± 1.28	<0.001***
FS (mean ± SD)	46.50 ± 19.74	19.75 ± 13.22	<0.001***
MO (mean ± SD) cm	3.79 ± 0 .96	4.65 ± 0.50	<0.001***

Paired t-test & Wilcoxon Signed Ranks test # were used.
PR: Pain at Rest, VAS: visual analogue scale, PM, Pain on Movement, FS: Fonseca Scale; MO, Mouth Opening
*** Very high statistically significant difference (p<0.001).

Concerning the difference among the mean of each clinical parameter before and after the exercise Program between both genders and between unilateral & bilateral joint affection, no significant difference was found (not shown in tables). To find a statistical correlation, differences in pain (at rest & with movement), Fonseca's scales, and mouth opening before and after Rehab were considered and Spearman's correlation test was used. Only a weak inverse significant correlation between TMD duration and pain at rest difference was detected, otherwise, no other significant correlation was found (**Table 3**).

Table 3: Correlation between TMJ disorder duration and mean difference of clinical parameter

Clinical parameter (mean difference)	TMJD duration	
	R	P-value
PR df	-.480	.032*
PM df	.059	.804
FS df	-.147	.535
MO df	.240	.307

Spearman's correlation test was used.
Mean difference= (mean after Rehab. –mean before rehab.).
PR df: Pain at Rest mean difference, PM df: Pain on Movement mean difference,
FS df: Fonseca Scale mean difference, MO df: Mouth Opening mean difference;
* Statistically significant difference (p<0.05).

DISCUSSION

Temporomandibular disorder (TMD) is a common condition that is usually classified as a subtype of secondary headache disorder[11]. Although many studies revealed that 40% to 75% of adult populations have at least one sign of TMJ dysfunction including pain, tenderness, clicking sound, or limited mouth opening, only 3% to 7% of the population sought medical advice for their complaints[12].

It has been stated that TMD is 1.5-2 times more common in females than in males[13,14]. In agreement with that, in the current study, 55% of the patients were females.

Repetitive jaw movements, jaw positioning as in violinists and singers, and parafunctional movements of the TMJ including nail biting, gum chewing, and pipe smoking are thought to correlate with the TMD although not formally studied [15].

Teleneurorehabilitation and telecardiac rehabilitation were the most commonly studied areas in telerehabilitation[16,17]. Studies on the telerehabilitation of depression were also found[18].

To our knowledge, no previous study investigated the effectiveness of telerehabilitation on TMD.

We found a non-significant correlation between bruxism; nail biting, gum chewing and frequent dental procedures with the different TMD manifestations in the studied patients. However, in a systematic review, a slightly weak association was found between bruxism and TMD [19].

In this study, cervical pain was encountered in half of the studied patients. Cervical malalignment is thought to be one of the causes of pain in TMD probably due to the muscular connection between the cervical and TMJ muscles. Meanwhile, a systematic review reported an unclear correlation between cervical and head posture with TMD due to the poor methodological quality of the included articles[20]. However, the existence of a relationship between TMD pain and cervical plexus is suggested by some evidence[21].

TMJ dysfunction is manifested by pain, reduced mouth opening, clicking noise with mandibular movement, jaw locking or deviation, and involuntary jaw clenching.

Management of the TMD usually aims at controlling pain and improving jaw function.

Recent studies reported that the TMJ pains are mostly self-limiting and conservative therapy should be the first line of treatment. Conservative treatment includes patient education, self-care, and physical therapy[22]. An individualized patient education program is a core component in TMD treatment[23–25].

The key elements in patient education include assurance and explanation of the nature of the condition,

advice to avoid parafunctional habits such as nail biting and teeth clinching, food consistency modification, home-based exercises and practicing precautions during mastication and yawning like avoidance of end range positions[26].

We found a highly significant statistical difference between TMJ pain at rest and with movement, mouth opening, and Fonseca's scale before and after the treatment.

In this study, active stretching range of motion exercises to the TMJ was the main exercise program done by the patients. Stretching exercises are considered the initial therapy for painful TMD when pain interferes with the TMJ function. They aim to decrease pain and improve flexibility and range of motion by increasing local circulation and relaxing the spastic muscle [23,27–29].

We used rhythmic contraction and relaxation technique to stretch the jaw muscle. This is a technique where the contraction of one group of muscles is followed by their relaxation[30,31].

An example of these exercises is the opening of the mouth followed by closure, protrusion of the mandible followed by retraction, and deviation of the mandible in either direction. Actually, in our exercise program, we made good use of gravity as an agonist if the movement was done in the direction of the gravity force, and as an antagonist, if the movement was done in the direction against the gravity force. This was done by performing the exercises in different body postures. In this way, an element of strengthening was added to the exercises at the part when the direction of movement is against the gravity force.

Superficial and deep heat modalities, transcutaneous electric nerve stimulation (TENS), and friction massage were given initially to all patients for only one session. We aimed to decrease pain, relax the muscles and motivate the patient to engage in the home-based exercise program.

Physical therapy using electrical modalities and exercises has been reported to be an effective inexpensive and safe treatment method for TMD[32]. It decreases pain and improves the range of motion (ROM) in TMD cases[28,33]. However, a single physiotherapy session gives only a very short-term effect that has no impact on chronic conditions and would never last for a long duration as 3 months follow-up period of this study.

Although the fact that physical exercise may be a fixed element within the conservative treatment of TMD in many types of research, no specific program has been recommended to be the simplest to follow. This might be explained by the marked variability within the study designs, patient populations, exercise programs, the patient understanding of the exercise technique, and the presence of multimodal approaches[34].

In contrast to our results, a study involved 49 TMD patients with non-reducible anterior disc dislocation and assigned them to education alone or education plus physical therapy. It found no significant differences between both groups[35]. The plausible explanation for this conflict is the lack of internal derangement in our patients' TMJ.

Fifty percent of our patients had complained of neck pain for which a physical therapy program was applied. Addressing and treating cervical problems is an important part of the treatment of TMD. This help fastens the rehabilitation program[34]. A weak inverse correlation between the TMD duration and the difference in pain at rest was detected in this study. This could be a logical result where with chronicity of the TMD, little improvement in pain at rest was encountered.

Because it is a pilot study with a small number of patients, further case-control studies on a larger study population are recommended. A longer follow-up period is also recommended with the involvement of more objective measures of improvement on the symptomatic and functional level of TMJ.

CONCLUSION

In conclusion, this pilot study showed that during the lockdown period of COVID-19, telerehabilitation of chronic refractory TMD with no internal derangement in the form of home-based well-chosen exercises was effective in reducing the pain both at rest and with movement, improving the range of motion and the severity of TMD manifestations.

DECLARATIONS

- **Consent for Publication:** I confirm that all authors accept the manuscript for submission
- **Availability of data and material:** Available
- **Competing interests:** None
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