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Treating Trismus with Dynamic Splinting: a Cohort, Case Series

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ABSTRACT

Introduction: The purpose of this study was to retrospectively evaluate the effect of the Dynasplint® Trismus System (DTS; Dynasplint Systems Inc, Severna Park, Md, USA) for patients who were recently diagnosed with trismus following radiation therapy, dental treatment, oral surgery, or following a neural pathology such as a stroke.
Methods: We reviewed 48 patient histories (treated in 2006–2007), and divided into 4 cohort groups (radiation therapy for head/neck cancer, dental treatment, oral surgery, or stroke), to measure the efficacy of this treatment's modality. Patients were prescribed the DTS after diagnosis of trismus based on examination that showed <40 mm maximal interincisal distance. The DTS uses low-load, prolonged-duration stretch with replicable, dynamic tension to achieve longer time at end range (of motion). Each patient used this device for 20–30 min, 3 times per d.
Results: This cohort case series showed that there was a statistically significant difference within all patient groups ($P<0.0001$; $t=10.3289$), but there was not a significant difference between groups ($P=0.374$).
Conclusion: The biomechanical modality of DTS with a low-load, prolonged-duration stretch was attributed to the success in reducing contracture in this study. This improved range of motion, allowing patients to regain the eating, hygiene and speaking patterns they had before developing trismus.

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INTRODUCTION

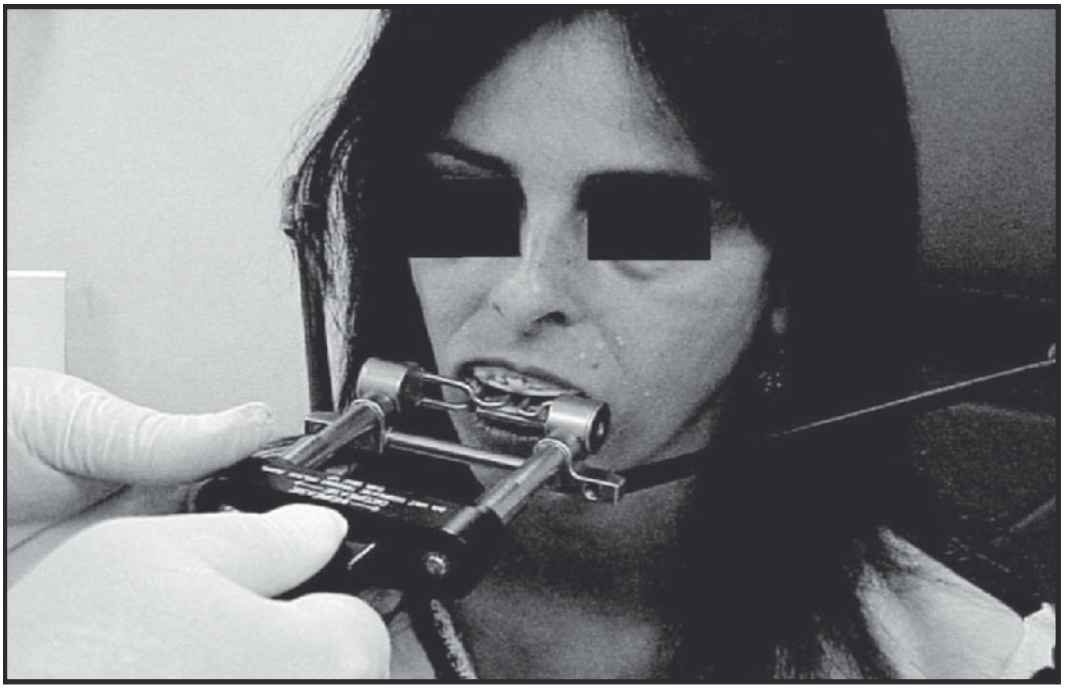
Trismus is described as a pathological condition of the muscles of mastication, and commonly affects patients who are undergoing radiation therapy either to treat head/neck cancer, following oral surgery, dental procedures, or following a stroke. Trismus is a result of the sustained contraction of 1 or more of the muscles of mastication, the masseter, temporalis or pterygoid muscles. This can yield contracture of the connective tissue resulting in a restriction in mouth opening.[1–4] This condition affects a broad range of patients. Trismus is diagnosed from clinical examination of the maximal interincisal distance (MID), which represents the distance from the incisal edge of the maxillary and mandibular incisors. In edentulous patients, it is measured between the maxillary and mandibular alveolar ridges. A measurement of <40 mm is classified as trismus (Figure 1).[1,4,5]

When radiation therapy is used in the treatment of cancer patients (tumours of the nasopharyngeal area, salivary gland, and/or the maxilla or mandible), the incidence rates for trismus ranges from 10% to 40% of patients.[4,6–9] Trismus significantly affects and deters one's activities of daily living by producing challenges in eating and oral hygiene; one's speech is also dramatically affected by trismus.[1,2,5,10–12]

The hypomobility of this condition may result in contracture of the connec-

Figure 1. Illustration of maximal interincisal distance.

Figure 2. Dynasplint® Trismus System.



tive tissue and degeneration of the musculature.[2] Previous treatment methods have included manual manipulation with wooden splints such as tongue depressors or other oral stretching devices, which exert a high-intensity force for a short duration. The Dynasplint® Trismus System (DTS; Dynasplint Systems Inc, Severna Park, Md, USA) uses the low-load, prolonged-duration stretch that has been proven effective in reducing contracture associated with other pathologies, and the Dynasplint Systems mouthpieces can be customised for partially edentulous patients[13–15] (Figure 2). The DTS uses reproducible, calibrated tension for adaptation to changes in the end range (of motion) versus a manual stretch-and-release protocol that is not calibrated or controlled.

The progression of trismus can be slow or as dramatic as 2.4% per mo for

Table 1. Patient demographics.

Pathology	*n*	Gender, male/female	Age±SD, y
Radiation	20	10/10	44±12
Dental	17	11/6	39±9
Neural	7	3/4	53±10
Oral surgery	4	4/0	41±11

SD=standard deviation.

nasopharyngeal cancer patients treated with radiation therapy.[1] Proactive treatment would thereby benefit patients and prevent decreases in MID.[7] The affected muscles include the buccinator, temporalis, masseter, medial pterygoid, and lateral pterygoid. The continued contraction causes a physiological change by shortening the connective tissue, and this contracture will cause the secondary atrophy of the musculature.

The purpose of this study was to retrospectively evaluate the effect of using the DTS for patients who were recently diagnosed with trismus following radiation therapy, dental treatment, oral surgery, or following a neural pathology such as a stroke.

METHODS

Participants

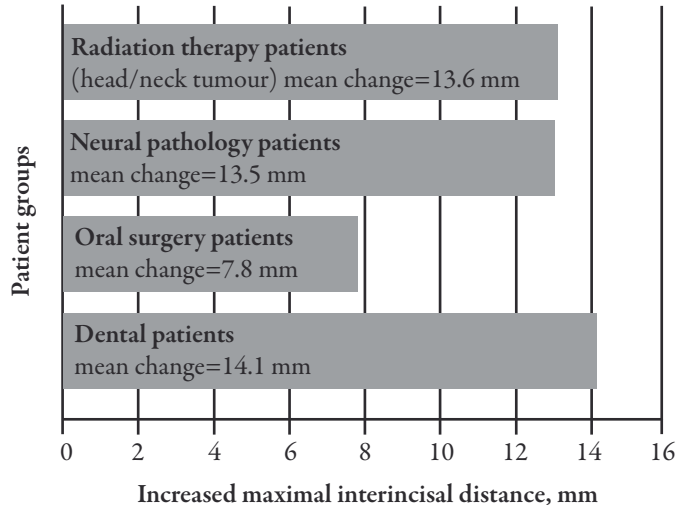
Case histories were acquired for 48 patients who had developed trismus following radiation therapy, dental treatment, oral surgery, or neural pathology such as a stroke. These patients had completed range-of-motion therapy with the DTS during the past 2 y to increase the MID, and had been treated for 6 mo at 1 of 3 different therapeutic locations in the USA where MID changes were recorded (Table 1).

The DTS uses a low-load, prolonged-duration stretch to deliver a correct biological stimulus to modify the connective tissue.[13] The device is worn with adjustable bilateral tension rods that can be altered for patient comfort and to achieve greater range of motion for increasing the MID.

Procedures

Patients' initial introduction to the DTS included customised fitting (moulded patient mouth pieces) and training on donning and doffing of the devices. Verbal and written instructions were provided

Figure 3. Changes in maximal inerincisal distance by pathology following treatment with the Dynasplint® Trismus System on 4 patient groups.



throughout the duration of treatment for safety, general wear and care, and tension-setting goals, based on patient tolerance.

The patients were instructed to wear this device 3 times per d (minimal tension settings) with gradual increases in time and tension as tolerated. The goal for each patient was to wear the DTS for 30 min, 3 times per d. The tension was to be increased 1 increment every 2 wk, based on patient tolerance and comfort.

Statistics

The dependent variable in this study was change in MID. All pathologies causing this condition were categorised by pathology and statistical analysis of the change was accomplished using a paired *t* test. A post-hoc analysis of variance (1-way ANOVA) was performed to determine difference between groups.

RESULTS

There was a statistically significant difference in MID for all patient groups ($P<0.0001$; $t=10.3289$; standard deviation=9.14). Figure 3 shows that all groups accomplished increased MID following treatment with DTS; the mean change was 12.8 mm, and the range was 0–28 mm. No significant difference was observed between groups ($P=0.374$).

As the change in MID was consistent for all patient categories, the biomechanical action of stretching the mandibular opening with a low-load, prolonged-duration was considered responsible for this change. Consequently, dynamic tension was effective in this study for reducing contracture (Table 2).

DISCUSSION

Previous techniques of treating trismus with manual stretching and stretching of the MID with tongue depressors has achieved varied results.[15] Dynamic splinting has been shown to be effective in treating contracture arising from different pathologies, and low-load prolonged-duration stretch with replicable, adjustable, bilateral tension would be a beneficial tool in treating trismus.[13,14,16]

The purpose of this study was to retrospectively evaluate the effect of using the DTS for patients who were recently diagnosed with trismus following radiation therapy, dental treatment, oral surgery,

Table 2. Patient maximal interincisal distance scores before and after treatment with the Dynasplint® Trismus System.

Results	Initial MID	Final MID
Mean	24.97 mm	37.63 mm
Standard deviation	9.64	9.14
Standard error of the mean	1.39	1.32
n	48	48

MID=maximal interincisal distance.

or following a neural pathology such as a stroke (Figure 3).

The DTS protocol, which uses low-load prolonged-duration stretch for treating trismus, is new and has not yet been evaluated in current research. Jansma et al.[7] suggest using exercise therapy as a proactive protocol, to be initiated on the first day of radiation therapy, but Dijkstra et al.[17] conclude that "Trismus related to head and neck cancer is difficult to treat with exercise therapy." Exercise therapy often has uncontrolled variation in intensity and direction of stretching[17] but the DTS offers a specific biomechanical alignment with a customised mouth piece to control the direction and intensity of the therapeutic stretching.

In our case series study the DTS modality showed efficacy not equalled in current research. However, as this was a case series investigation, it was limited by the fact patient treatment methods were not compared with a control group and that selection was not randomised. Future studies should include a randomised, controlled, crossover study of this unit to compare the efficacy of treating trismus, and a case/control study could evaluate prevention of trismus with the DTS.

In conclusion, this study showed a statistically significant benefit for patients fitted with DTS ($P<0.0001$), and that the technique of using a biomechanical adaptation to achieve a physiological change can be effective in treating trismus. The overall benefit for patients using treatment was regaining the range of motion required for normal eating, hygiene, and speaking, which had been diminished due to trismus.

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