A jaw exerciser for fibrous ankylosis of the temporomandibular joint

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ABSTRACT—Indications for the use of an individually designed jaw exerciser together with the method of fabrication and patient instructions and reports of two cases of post-traumatic progressive fibrous ankylosis of the temporomandibular joints are described.

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Introduction

Jaw exercisers can be divided into five types: screw¹ or wedge, cast metal cap splints activated by elastic traction,¹ hand operated devices,¹ extra-oral devices activated by elastic traction,^{2,3} and screw-type mouth gag.⁴

The suggested treatment for progressive fibrous ankylosis of the temporomandibular joints has been condylar surgery,⁵ forced jaw manipulation under general anaesthesia with a Mason gag,⁶ anti-inflammatory medication and deep heat therapy with exercises⁶ contraindicated, and the use of an acrylic screw.¹

The purpose of this paper is to illustrate and outline the use of the scissor-type cap splint jaw exerciser as a successful conservative form of treatment for progressive fibrous ankylosis of the temporomandibular joints.

Fabrication and instructions

Since restricted movement reduces mouth opening, alginate impressions using adjusted stock trays are obtained for models of the upper and lower arches. Upper and lower cast silver cap splints are fabricated and to each splint three millimetre diameter brass rods are silver soldered to form the exerciser. The rods are designed to retain elastic bands necessary to promote opening movements (Fig. 1) when the splints are placed in the mouth.

Initially the exerciser is operated for a minimum of 30 minutes and not more than 1 hour daily. The patient is advised that daily exercises will be required for six months⁶ and initially movement is obtained with one rubber band (diameter 90 mm, width 3 mm, thickness 1 mm). The tension of the elastic band draws the ends of the rods together and depresses the mandible so that the mouth is opened. Obviously the maxilla functions as anchorage in those movements and careful instructions must be given to the patient so that when maximum opening is reached the mouth is slowly closed. The exercise is repeated for the time indicated within the patient's tolerance. The patient is informed that any pain experienced during the exercise arises from muscle fatigue and the breaking down of fibrous adhesions.

Initially exercises are performed with one elastic band and the patient proceeds by increasing the tension using additional elastic bands to a maximum of four. When

¹ Rowe NL, Killey HC. Fractures of the facial skeleton. 2nd edn. London: ES Livingstone, 1968;796-802.

² Rahn AO, Boucher LJ. Maxillofacial prosthetics. Philadelphia: WB Saunders, 1970:176-80.

³ Beumer III J, Curtis TA, Firtell DN. Maxillofacial rehabilitation. St. Louis: CV Mosby, 1979:534-6.

⁴ Nakajima T, Sasakura H, Kato N. Screw-type mouth gag for prevention and treatment of post-operative jaw limitation by fibrous tissue. J. Oral Surg 1980;38:46-50.

⁹ Moore JR. Principles of oral surgery. 2nd edn. Manchester: Manchester University Press, 1976;227-38.

Bell W. Clinical management of temporomandibular disorders. Chicago: Year Book Medical Publishers, 1982:167-212.



Fig. 1.—An anterior view of the scissor-type jaw exerciser.

a mouth opening of 30 mm is reached daily exercises of 10 minutes duration are continued for six months when reassessment is made.

Case reports

Patient No. 1

A woman, aged 37 years, was referred because of limited mouth opening and otalgia. The patient had been punched about the face, including the region of the joints, four years previously. Previous occlusal therapy failed to relieve the symptoms in the right temporomandibular joint in which movement caused pain and crepitus. The occlusal therapy, over approximately one year, consisted of the construction and continual adjustment of an acrylic occlusal splint which was worn at night. Conservative and accurate occlusal adjustment of the teeth also had been performed but the symptoms increased and routine operative procedures became impossible because of the limited opening of the mouth. Mastication was now restricted to small open and close types of movement, lateral chewing was impossible and jaw locking occurred occasionally during mastication.

These jaw movements were not painful unless excessive biting force or opening was attempted. The patient's major concern was the ever decreasing mouth opening which had become more noticeable in the preceding year.

Clinical examination

The patient was dentate except for the 16, 36, and 46 teeth. There were no carious or painful teeth and no lymphadenopathy of the head or neck. Palpation of the muscles of mastication and the temporomandibular joints revealed no tenderness and no scarring was observed. However, the masseter muscles appeared atrophied. A

functional occlusal analysis revealed a postero-anterior slide, of approximately 0.5 mm, of the mandible from dysfunctional⁷ centric relation to centric occlusion position. There were no noticeable protrusive, working or non-working side interferences, the mouth opening was 17 mm and lateral movements of the jaw were restricted preventing an edge to edge position.

Radiographic examination

Lateral and postero-anterior tomograms of the joints were obtained (Fig. 2, 3) and revealed that in the open position both condyles failed to translate to the apex of the articular eminence. A radiopaque area approximately 1.0 mm in diameter (see arrow) was evident before treatment in the anterior temporomandibular joint space on the right side (Fig. 2, 3). Diffuse radiopacities were present before treatment around both joints in the region from the articular eminence to the condylar head (Fig. 2, 3).

Treatment, results and prognosis

In view of the history, signs and symptoms of this condition, a clinical diagnosis of fibrous ankylosis of the temporomandibular joints was made.⁶

A jaw exerciser was fabricated and instructions given as outlined above. The patient used the exerciser in accordance with these instructions and suffered mild pain, reaching a peak at the completion of each exercise.

Maximum mouth openings were measured at intervals after treatment started and reached 26 mm at 4 months, 33 mm at 11 months and finally 38 mm at 24 months.

⁷ Weinberg LA. Temporomandibular joint function and its effect on concepts of occlusion. J Prosthet Dent 1976;35:553-66.



Fig. 2.—Lateral tomographic views of the right (R) joint in the open (o) and closed (c) positions, before treatment, with arrow indicating a radiopaque speck. Note that in the open position the condyle does not translate to the eminentia but stops in the region of the speck.



Fig. 3.—Lateral tomographic views of the left (L) joint in the open (o) and closed (c) positions, before treatment, with arrow indicating diffuse radiopacities in the region from the articular eminence to the condylar head. Note that in the open position the translation of the condyle towards the articular eminence is minimal.



Fig. 4.—Lateral tomographic views of the right (R) joint in the open (o) and closed (c) positions after 12 months treatment. Note the radiopaque speck is absent and the condyle can translate to the eminentia.



Fig. 5.—Lateral tomographic views of the left (L) joint in the open (o) and closed (c) positions after 12 months treatment. Note the diffuse radiopacities are absent and the condyle can translate to the eminentia.



Fig. 6.—Sectional views of an orthopantomograph, before treatment, with the jaw in the closed (c) position reveals a condylectomy has been performed on the left (L) side. On the right (R) side a *high* condylectomy has been performed and the joint space appears narrow.



Fig. 7.—A lateral tomographic view of the right (R) joint, after treatment, in the closed (c) position reveals a normal size joint space.

After 15 months the patient's mouth opening reached 36 mm which permitted routine operative dentistry. The patient reported the crepitus and otalgia had disappeared and normal mastication was possible. The mouth opening after one year of exercises was stable and the radiopacities present around the joints had disappeared (Fig. 4, 5).* The patient exercised for half an hour daily with some exceptions for the first eleven months, and then three times a week for a further seven months prior to ceasing.

Patient No.2

A woman, aged 55 years, was referred with a deteriorating mouth opening which was first noticed following a motor accident ten years previously, when facial injuries were sustained. Presumably both condyles were injured but the patient was not sure of the exact damage. After the accident she noticed the amount of mouth opening was limited and slowly decreasing. Four years after the accident a left condylectomy and, in the following year, a right *high* condylectomy had been performed to treat the problem. The results were good initially, but over the last two years the trismus had further increased and she was unable to masticate properly, being restricted to small open and close type movements. The mouth opening was only 12 mm.

Clinical examination

Palpation of the muscles of mastication and soft tissues adjacent to the mandible revealed no abnormality and eight teeth, 16,26,27,34,36,44,46, and 47, were missing.

A functional occlusal analysis revealed a mouth opening of 12 mm, edge to edge, lateral and protrusive movement being impossible. On opening there was a marked deviation of the mandible to the left.

Radiographic examination

A panoramic radiograph of the mandible and joints revealed evidence of the previous surgery (Fig. 6). No calcification of the joint spaces was evident. However, the right temporomandibular joint space was not uniform and appeared undersized.

It should be noted that two different types of tomographic equipment was used resulting in an apparent difference in size of the condyles between Fig. 2, 3 and Fig. 4, 5.

Treatment, results and prognosis

In view of the history, signs, and symptoms, a clinical diagnosis of progressive fibrous ankylosis of the temporomandibular joints was made.

A jaw exerciser was fabricated and despite instructions the patient used it twice daily for fifteen minutes each time. She experienced no discomfort or pain and commented about the sensation of 'stretching of the joints' during exercises.

Maximum mouth openings were measured at intervals after treatment started and reach 27 mm at 6 months, 30 mm at 9 months and 32 mm at 18 months, even though the patient had ceased to use the exerciser after nine months.

The patient was satisfied with this degree of mouth opening and was capable of masticating reasonably well. The mouth opening achieved was considered adequate in view of the past surgery. There has been no relapse since treatment was completed two years ago. A tomograph 18 months after treatment revealed a relatively normalsized right temporomandibular joint space (Fig.7).

Discussion

The technique described is simple and it has been used successfully in a number of instances avoiding the necessity of surgical intervention.

Limited mouth opening arising from intra- or extraarticular fibrosis appears to be overcome by treatment with jaw exercisers which are more effective than other devices since gradual bilateral opening traction is exerted on the mandible in contradistinction to those devices which have limitations where the force is applied only to part of the mandible, often via the incisors.

The scissor type exerciser allows a force to be applied to the whole mandible and this results in a predominantly inferior displacement of the condyles with rotation. This movement may allow a displaced disc, if present, to return into an optimal position in the fossa and aid in 'freeing up' fibrous adhesions of the condyle-disc-muscle mechanism.⁶ The cap splints are not cemented on the teeth as they are stable even with the heavy pressure exerted by the elastics.

Conclusion

The use of the cap splint scissor-type jaw exerciser for two cases of fibrous ankylosis of the temporomandibular joints has been described. A significant clinical improvement in mouth opening and masticatory function occurred in both without any relapse.

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