THE USE OF A DYNAMIC OPENING DEVICE IN THE TREATMENT OF RADIATION INDUCED TRISMUS

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ABSTRACT
A commonly observed sequela of radiation therapy for malignancy of the head and neck is trismus. Patients may experience a marked restriction of jaw opening and overall mobility, which is of great concern and lessens the quality of life. A 66 year old edentulous man experiencing radiation therapy induced trismus was treated with a dynamic opening device to improve his opening and range of movement, before new maxillary and mandibular complete dentures were constructed for him.

Key words: Radiotherapy, trismus, trismus device, Dynamic Opening Device.
INTRODUCTION

Malignancy of the epithelial lining of the oral and oropharyngeal regions is often treated by a combination of surgery and radiation therapy (Shafer et al. 1983, Beumer et al. 1979).

Although a great deal of planning and care are taken in reducing exposure of healthy tissue to the radiation source during treatment, undesirable side effects still occur. Radiation adversely affects the salivary glands, oral mucosa, mandibular musculature and alveolar bone. Some of the more common adverse clinical consequences observed following radiation therapy are xerostomia — with resultant difficulties with speech, swallowing and taste loss and rampant caries — mucositis, osteoradionecrosis and trismus, where the word trismus is used in its broadest sense (Beumer et al. 1979; Kouyoumdjian et al. 1986; Maxymiw and Wood 1989; Rahn and Boucher 1970; Shafer et al. 1983).

Trismus occurs most frequently when the field of radiation involves the muscles of mastication and the temporomandibular joints (Beumer et al. 1979). It is believed to occur as a result of radiation induced fibrosis of the masticatory muscles (Maxymiw and Wood 1989), direct damage to one or both of the temporomandibular joints, damage of the trigeminal nerve, or fibrous adhesions of scar tissue between the maxilla and mandible or within the overlying skin (Lund and Cohen 1993). It has also been suggested that trismus following radiation therapy may be a protective reflex response to post treatment pain (Jekel et al. 1987).

The onset of trismus after radiation therapy has been reported to occur from very early in the post treatment phase up to three to six months later (Rahn and Boucher 1970). The frequency and severity of trismus after radiation therapy remains unpredictable (Beumer et al. 1979).

Exercising of the mandible during and immediately after radiation therapy has been advocated to minimize the formation of fibrous scar tissue (Beumer et al. 1979). However, failing this, many other forms of treatment for post radiation therapy trismus have been proposed in the literature (Beumer et al. 1979; Kouyoumdjian et al. 1986 and 1988; Lund and Cohen 1993).

It goes without saying that prior to the commencement of treatment of trismus, a thorough and careful assessment is made as to its cause. A history of radiation therapy indicates the necessity to overcome oedema, circulatory inefficiency and to soften and stretch fibrous tissue formed during the reparative phase of healing (Lund and Cohen 1993). The physical therapies of heat and massage together with exercise have been advocated (Beumer et al. 1979; Kouyoumdjian et al. 1986 and 1988; Lund and Cohen 1993).

CASE REPORT

The case report describes the treatment and follow-up of a 74 year old man who, 8 years ago, was treated for a squamous cell carcinoma of the mucous lining of the oro-pharynx by a combination of surgery and radiation therapy (Fig. 1). Three months following the above treatment, he presented with a marked restriction of mouth opening and was unable to wear his maxillary and mandibular complete dentures.

A clinical assessment of the patient showed that he had severe restriction of mouth opening (maximum opening of 15 mm), and the maxillary and mandibular alveolar ridges and their surrounding tissues had been markedly altered by the treatment given him.

As it was felt that it would be difficult to provide him with suitable maxillary and mandibular complete dentures with his present, very restricted degree of mouth opening, it was decided to provide him with an appliance which would increase his overall range of jaw movement.

A Dynamic Opening Device was constructed for the patient. The appliance consists of an extra oral steel framework which is attached to intra oral maxillary and mandibular acrylic base plates. Elastic bands are attached to the framework bilaterally. These apply a firm and constant opening force between the maxilla and mandible.

Many mechanical methods are advocated for the treatment of trismus some of which, as described by Kouyoumdjian et al. (1988) and Lund and Cohen (1993), are spring appliances, acrylic cones/wedges, tongue depressors and clothes pegs. The authors chose to utilise the Dynamic Opening Device as it

Fig. 1. The patient's orthopantomograph showing the surgical site.
was felt that the patient's limited opening was due largely to fibrosis and damage of the soft tissues and musculature induced by the previous radiation therapy and surgery. The Dynamic Opening Device was chosen as its design is very versatile and allows it to be modified for use in edentulous patients and its success is well reported (Rahn & Boucher 1970, Beumer et al. 1979.)

**DESIGN (After Rahn & Boucher 1970)**

Impressions are made of the edentulous ridges on which maxillary and mandibular acrylic base plates are constructed. To the two buccal edges of each of these base plates is added a 10 gauge metal rod of approximately 35 to 40 cm length (Fig. 2, 3).

Both rods are contoured to exit from the mouth at around the commissures and extend posteriorly along the cheeks parallel to the plane of occlusion. The force to be generated by this device must be applied through a fulcrum axis which would be through the premolar area in a dentate mouth. A U-shaped crimp should therefore be placed in each mandibular rod in the same vertical plane as the fulcrum line (Fig. 4).

The maxillary rod is extended back to the auricular region where it is bent back on itself downwards and forwards. Another U-shaped crimp is now placed this time in the maxillary rod near its end and directly below the mandibular crimp, such that a distance of approximately 10 cm separates the two.

Placement of elastics around the mandibular and maxillary notches now creates a pull which produces an opening force on the mandible. Various elastics capable of exerting differing amounts of tension were tried. Finally, elastics were selected for which the size and tension were found to be suited to the design of the appliance, and which were found to be the most comfortable and manageable by the patient (Fig. 5, 6).

The patient experienced little to no difficulty in adapting to the use of his appliance (Fig. 7). Within approximately four weeks, his degree of mouth opening and jaw movement had increased sufficiently (to approximately 38-40 mm) to allow impression making and jaw registration procedures to be undertaken and new maxillary and mandibular complete dentures to be made with minimal difficulty.

Now eight years since first treatment, the patient still retains his Dynamic Opening Device and continues to use it intermittently whenever he experiences any stiffening of the jaw, which tends to occur from time to time.

**SUMMARY**

Trismus is a phenomenon which is frequently encountered by patients after radiation therapy of the head and neck. Its frequency and severity is unable to be confidently predicted.

After a thorough differential diagnosis of the condition and its aetiology, the physical therapies of heat, massage and exercise are normally advocated.

Many trismus treatment devices are advocated, some of which are complex, time consuming and expensive to construct. Even after financial restrictions are overcome, the patient's compliance is necessary for success.
The bulkier and more complex devices often cause patients concern through self-consciousness of their appearance. Thus although deemed to be very effective devices by most reporters, their success may be diminished in some instances.

The provision of a trismus appliance may be a very beneficial modality for treatment of limited jaw movement, and although the dynamic opening device was used to good effect in the above case report, final selection of an appliance design ought to involve consideration of patient acceptance and ease of use.

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REFERENCES


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