CASE REPORT

Cross-arch arrangement in complete denture prosthesis to manage an edentulous patient with oral submucous fibrosis and abnormal jaw relation

Abhijit Tambe, Sanjayagouda B Patil, Sudhakara Bhat, Mokshada M Badadare

Department of Prosthodontics,
Sri Hasanamba Dental College
and Hospital, Hassan,
Karnataka, India

Correspondence to
Dr Sanjayagouda B Patil,
sbpatilmanu@gmail.com

Accepted 27 August 2014

SUMMARY

A patient with oral submucous fibrosis and resorbed ridges poses a challenge for prosthodontic rehabilitation because of the limited mouth opening and fibrotic mucosa. The fabrication of prosthesis is very difficult due to abnormal jaw relations, influencing the long-term prognosis of the patient. To present a case of oral submucous fibrosis with severely resorbed edentulous ridges which was successfully managed by adopting a modified technique in fabricating a complete denture prosthesis. A 55-year-old female patient with completely edentulous maxillary and mandibular arches diagnosed with oral submucous fibrosis was rehabilitated with complete dentures by recording neutral zone for resorbed mandibular ridge and by arranging the posterior teeth in cross arch relation for compensation of the abnormal jaw relations. The cross-arch arrangement of posterior teeth provides a more stable and retentive complete denture prosthesis for patients with severely resorbed ridges and a wider mandibular arch.

Successful complete denture treatment depends on many variables; of these, three factors stand out in terms of functional success: retention, stability and support. In case of severely resorbed ridges, it is difficult to achieve these factors, and it is generally agreed that stability is the factor that is most affected.

The objective of complete denture therapy is placement of functional and aesthetic dentition substitutes, which is difficult to achieve in cases with severe residual alveolar ridge resorption along with abnormal jaw relations. This can be achieved by correctly recording the denture bearing area, properly arranging the teeth and proper contouring of the polished surface area of the dentures.

The aim of the present article is to describe the fabrication of a complete denture for an edentulous patient wherein simple modifications were adopted to manage oral submucous fibrosis along with severely resorbed ridges and a wider mandibular arch.

BACKGROUND

Oral submucous fibrosis is a premalignant condition which affects the oral cavity and sometimes the pharynx.¹ This condition predominantly affects people of South and South-East Asia who are commonly involved in chewing of areca nut and its commercial preparations. Arecoline, a component of the areca nut, plays a major role in the pathogenesis of the disease. Other aetiological factors such as nutritional deficiencies, immunity of the person and genetic predisposition may contribute to the disease process.

The clinical features of submucous fibrosis differ according to the stage of the disease process. Most patients present with difficulty in opening the mouth and difficulty in protruding the tongue. Burning sensation of the oral mucosa with intolerance to spicy foods is another feature of this disease. Ulceration of the oral mucosa may be present in some patients. Palpable fibrous bands and pallor in the oral mucosa support a clinical diagnosis of the condition. In case of edentulous patients there is limited scope for surgical correction due to deteriorating systemic health of the patient. The main problem encountered in such patients is making a good impression due to the reduced mouth opening and gaining adequate extension of the denture flanges due to the shallow vestibules, which lead to a lack of peripheral seal.

CASE PRESENTATION

Case report

A 55-year-old female patient reported to the department of Prosthodontics with symptoms of inability to chew food and impaired aesthetics due to her missing teeth. Her dental history revealed that the maxillary and mandibular posterior teeth were extracted 5–6 years previously due to periodontal involvement and she never wore a removable partial denture for the missing posteriors. A few of her remaining anterior teeth were extracted around 6 months previously, and since then she has been edentulous with no replacement for the missing teeth. The patient reported a history of betel nut chewing over the past 25 years, four to five times a day, but that since the past 2 years she has quit this habit completely.

On intraoral examination, the oral mucosa, tongue and soft palate were found to be pale. Buccal and labial mucosae were stiff with the presence of thick fibrous bands. Elasticity of mucosa was lost because of the limited mouth opening. The entire maxillary and mandibular posterior ridges were found to be highly resorbed (class V—flat ridge form, inadequate in height and width²; figure 1) with fibres extending from the buccal mucosa to the crest of the ridge, resulting in a shallow buccal vestibule. The maxillary arch was narrower than the mandibular arch.

CrossMark

To cite: Tambe A, Patil SB, Bhat S, et al. *BMJ Case Rep* Published online: [please include Day Month Year] doi:10.1136/bcr-2013-203065

Figure 1 Intraoral maxillary and mandibular arch photographs.

TREATMENT

The treatment plan consisted of fabricating complete dentures with proper extension of the flanges and a recording neutral zone along with a cross-arch arrangement of the posterior teeth. Preliminary impressions were made by following conventional techniques of impression making with an impression compound. Sectional border moulding was carried out with a green stick compound and final impressions were made with zinc oxide eugenol impression paste with the selective pressure technique (figure 2). Care was taken during border moulding to correctly record the peripheral extension as the vestibular depth and width were shallow.

Orientation jaw relation was recorded using a Hanau spring bow and transferred to a semiaadjustable articulator (Hanau wide-vue -192 series, model# HANAU 014809-000). The vertical and centric jaw relations were recorded in the usual manner and casts mounted on the articulator (figure 3).

Next, another record base was fabricated with acrylic stops for recording the neutral zone in the resorbed mandibular arch (figure 3). The heights of acrylic stops were adjusted on the articulator and the green stick compound occlusal rim was fabricated at the same vertical height³ (figure 5). The neutral zone was recorded using the swallowing technique. In this technique, the patient is asked to swallow warm water so that the green stick compound is moulded as per the patient's movements.⁴ During the process of recording the neutral zone, the maxillary wax occlusal rim was in place to support the mandibular compound rim. A putty index was made to duplicate impression surfaces (buccal and lingual) of the neutral zone. The green stick compound and acrylic stops were removed from the denture base and the putty index was placed on the cast and wax was poured to complete the new occlusal rim fabrication⁵ (figure 4).

The mandibular wax occlusal rim thus obtained was much smaller in buccolingual width as compared with the wax rim, which was used for the earlier recording of jaw relations. The mandibular occlusal rim was now placed more buccally than the

maxillary rim (figure 4). Because of the more buccal placement of the mandibular rim, it was decided to arrange the posterior teeth in cross-arch arrangement to compensate for the wider mandibular arch. The putty index record of the neutral zone assisted in the arrangement of artificial teeth (figure 5).

According to the cross-arch arrangement, the right maxillary posterior teeth are arranged on the left mandibular arch, and the left mandibular posterior teeth are arranged on the right maxillary arch (figure 6). In the same way, by interchanging the location of the left maxillary posterior teeth and the right mandibular posterior teeth, the arrangement was completed. The mesiobuccal cusp of the mandibular first molar fits into the buccal groove of the maxillary first molar, though they are inverted.^{6 7} Thus, it maintains the anatomic relation even after the cross-arch arrangement of the posterior teeth. During the try-in stage, the stability and occlusion of complete dentures were verified. The dentures were processed in the usual manner using heat polymerised polymethyl methacrylate (PMMA) resin and cured at 74°C for 8 h. After bench cooling, the dentures were recovered, trimmed and polished. The dentures were delivered to the patient (figure 7A, B) and postinsertion instructions given.

OUTCOME AND FOLLOW-UP

The patient was recalled after the first day, then after a week. The patient was happy with the aesthetics and functional ability of the dentures (figure 8). After 1 year follow-up, the patient does not have any problems with the use of complete dentures.

DISCUSSION

During prosthodontic rehabilitation, patients who present with non-ideal/pathological conditions for replacement of missing teeth should be made aware of the limitations of the prosthesis. Proper treatment planning should be adopted so that a functionally acceptable prosthesis can be fabricated.

Figure 2 Final impressions for maxillary and mandibular edentulous arches showing reduced vestibular depth and width.

Figure 3 Mandibular record base with acrylic stops for recording the neutral zone.

Muscle activity is the most important factor in denture retention and stability. The neutral zone concept is advantageous in constructing complete dentures, when patients have compromised and wide mandibular alveolar ridges due to severe bone resorption in long-standing edentulousness. The artificial teeth are arranged exactly over the residual ridge according to the neutral zone so that buccolingual forces are neutralised, improving the stability of the denture and providing greater comfort to the patient.⁸

From their study, Fahmy and kharat⁹ concluded that there was greater comfort and improved speech clarity with the dentures fabricated using the neutral zone technique compared with conventionally fabricated dentures, but they did not notice any difference in chewing efficiency.

In the present case, it was decided to record a neutral zone for the mandibular arch as it was resorbed and wider as compared with the maxillary arch, and also the patient was diagnosed with oral submucous fibrosis where the cheek and tongue musculature became taut causing instability of the dentures. In cases with abnormal jaw relations where the posterior part of the mandibular arch is much wider than that of the maxillary

Figure 4 Final mandibular wax occlusal rim after recording the neutral zone.

Figure 5 Putty index used as a guide in the arrangement of artificial teeth.

Figure 6 Occlusal view of the maxillary and mandibular complete dentures. Note the arrangement of the posterior teeth (Mandibular teeth on the maxillary arch and vice versa.).

Figure 7 (A and B). Complete dentures inserted in the patients mouth with a cross-arch arrangement.

arch, the crest of the mandibular ridge is located further buccally than that part of the maxillary residual ridge. This leads to the problem of developing an adequate occlusal relationship between the maxillary and mandibular posterior teeth.

Depending on the clinical situation, various procedures can be used to compensate for the abnormal jaw relations (wider mandibular arch). If the difference in size of the arches is less, then it can be managed by the slight buccal arrangement of the maxillary posterior teeth so that it will have a satisfactory occlusal relationship with the opposing mandibular posterior teeth. Sometimes, owing to the non-axial forces, a more buccal placement of the maxillary posterior teeth can cause a midline fracture in the maxillary denture.

Another way of overcoming the problem in the arrangement of teeth due to the abnormal jaw relation is by using non-anatomic teeth. With non-anatomic teeth, achieving a satisfactory occlusal relation with the opposing arch will be easier than with semianatomic or anatomic teeth. However, Sutton and

McCord¹⁰ stated that complete dentures having a lingualised or anatomic posterior occlusal surface exhibited higher levels of self-perceived satisfaction compared with those with non-anatomic posterior occlusal teeth.

If the abnormality is more, that is, the mandibular arch is much wider than the maxillary arch, then the cross-arch arrangement posterior tooth is advised.⁷ The right maxillary posterior teeth are arranged on the left mandibular arch, and the left mandibular posterior teeth are arranged on the right maxillary arch. In this type of arrangement, there is a change of the arch as well as the side of the teeth; thus, the name cross-arch arrangement.

The arrangement of artificial teeth is based on biomechanical factors, which have a major role in the functional rehabilitation of complete dentures. An understanding of these factors is an important aspect in arranging the teeth. When the abnormality of the jaw relations is very marked, various modifications in the teeth arrangement, such as cross-arch arrangement of the posterior teeth, may be necessary to obtain satisfactory results.

Figure 8 The postoperative photograph of the patient rehabilitated with a set of functional and aesthetic complete dentures.

Learning points

- ▶ Perfect recording of the shallow vestibular depths is a must for wider area coverage.
- ▶ Recording of the neutral zone for stability of the dentures.
- ▶ Arrangement of artificial posterior teeth in cross-arch relation to compensate for abnormal jaw relations providing stable and retentive complete denture prosthesis with improved function.

Competing interests None.

Patient consent Obtained.

Provenance and peer review Not commissioned; externally peer reviewed.

REFERENCES

- 1 Angadi PV, Rao SS. Areca nut in pathogenesis of oral submucous fibrosis: revisited. *Oral Maxillofac Surg* 2011;15:1–9.
- 2 Cawood JI, Howell RA. A classification of the edentulous jaws. *Int J Oral Maxillofac Surg* 1988;17:232–6.
- 3 Alfano SG, Leupold RJ. Using the neutral zone to obtain maxillomandibular relationship records for complete denture patients. *J Prosthet Dent* 2001;85:621–3.
- 4 Makzoume JE. Morphologic comparison of two neutral zone impression techniques: a pilot study. *J Prosthet Dent* 2004;92:563–8.

- 5 Mou SH, Chai T, Shiau YY, *et al*. Fabrication of conventional complete dentures for a left segmental mandibulectomy patient: a clinical report. *J Prosthet Dent* 2001;86:582–5.
- 6 Goyal BK, Bhargava K. Arrangement of artificial teeth in abnormal jaw relations: maxillary protrusion and wider upper arch. *J Prosthet Dent* 1974;32:107–11.
- 7 Goyal BK, Bhargava K. Arrangement of artificial teeth in abnormal jaw relations: mandibular protrusion and wider lower arch. *J Prosthet Dent* 1974;32:458–61.
- 8 Cagna DR, Massad JJ, Schiesser FJ. The neutral zone revisited: From historical concepts to modern application. *J Prosthet Dent* 2009;101:405–12.
- 9 Wee AG, Cwynar RB, Cheng AC. Utilization of the neutral zone technique for a maxillofacial patient. *J Prosthodont* 2000;9:2–7.
- 10 Sutton AF, McCord JF. A randomized clinical trial comparing anatomic, lingualized, and zero-degree posterior occlusal forms for complete dentures. *J Prosthet Dent* 2007;97:292–8.

Copyright 2014 BMJ Publishing Group. All rights reserved. For permission to reuse any of this content visit <http://group.bmj.com/group/rights-licensing/permissions>.
BMJ Case Report Fellows may re-use this article for personal use and teaching without any further permission.

Become a Fellow of BMJ Case Reports today and you can:

- Submit as many cases as you like
- Enjoy fast sympathetic peer review and rapid publication of accepted articles
- Access all the published articles
- Re-use any of the published material for personal use and teaching without further permission

For information on Institutional Fellowships contact consortiasales@bmjgroup.com

Visit casereports.bmj.com for more articles like this and to become a Fellow