Eur. J. Prosthodont. Rest. Dent., Vol.19, No. 4, pp 175-178
Printed in Great Britain

© 2011 FDI World Dental Federation
doi:10.1922/EJPRD_975Shukla04

Modified Technique of Resection Denture Prosthesis Fabrication for a Patient with Segmental Mandibulectomy - A Case Report

P. Shukla*, C. Hegde*, N. Rampal*, Salil Pawah*, A. Gupta* and M. Shukla†

Abstract - *The rehabilitation of patients following maxillary & mandibular resection is challenging. A prosthesis supported with dental implants is often the treatment of choice, but implants cannot be used predictably in all clinical situations. A tissue supported post resection denture is usually the most acceptable treatment option left in these situations. This case report describes management of a patient who had undergone segmental mandibulectomy & subsequently rehabilitated with resection denture prosthesis. Conventional treatment planning was modified at various stages of fabrication to improve the quality of the final prosthesis.*

KEY WORDS: Resection denture, stability, segmental mandibulectomy, neutral zone, dental implants

INTRODUCTION

Prosthetic treatment after surgical correction of malignant overgrowths in the maxillary region is often successful in providing a pleasing appearance & acceptable oral functions. Post surgical prosthetic management in the mandibular arch is notoriously difficult, especially if a patient is edentulous [1,2]. Mandibular resection usually results in impaired speech, difficulty in swallowing, deviation of the mandible during movement, poor control of salivary secretions & severe cosmetic disfigurement. Psychological & social factors are equally associated with these cases[1] .

The psychological advantage of wearing dentures is considered to be vital in reducing effect of mutilation[2]. Therefore, rehabilitation of a patient after mandibular resection, though difficult, is an important aspect of a successful outcome.

Using dental implants to support a resection denture is an ideal approach[1,3,4,5]. Surgical treatment of mandibular carcinomas is frequently associated with adjunctive radiotherapy and there are many controversial issues in rehabilitation of irradiated patients using dental implants. These issues relate to the ability of the implant to osseointegrate in areas of radiation based on dosage and time elapsed after radiation exposure[1,3,4].

Implants in irradiated bone are associated with an increased risk of osteoradionecrosis, especially with irradiation above 50 Grays (Gys) [5,6,7]. Studies have shown that 50 Gys is a real threshold, with implant survival falling to 71% when dosages are increased beyond 50 Gys[8,9,10]. The time elapsed after radiotherapy seems to have effect on the prognosis of implants. Most studies have shown that the longer the period after radiotherapy, higher the success rate & the lower the risk of osteoradionecrosis. However, this subject is still controversial and investigators have recommended different periods to start implant treatment ranging from 3-6 months, 12 months, 24 months[11, 12, 13, 14, 15].

A high risk of recurrence/metastasis of a primary tumour is another concern when formulating any treatment plan. A mean recurrence rate of 45% has been reported at the end of 1 year for squamous cell carcinoma (SCC) of mandible[16]. The cumulative probabilities of recurrence were found to be 55.7% at 2 years and 75.9% at 5 years in other studies[17, 18]. When feasible, delayed implant placement may offer more predictable outcomes[19] .

This case report deals with management of a patient who had undergone segmental mandibulectomy & post surgical radiotherapy. Patient was subsequently rehabilitated with tissue supported resection denture prosthesis.

Case report

A 65 year old edentulous, male patient presented with difficulty in chewing. Medical records revealed history of squamous cell carcinoma (SCC) of the right buccal mucosa in mandibular molar area ($T_{4,}$ $N_{0,}$ M_0). Patient had been treated with surgical resection of neoplasm & reconstruction with pectoralis major myocutaneous flap. The patient also received post surgical radiation therapy with the total radiation dose of 60 Gys at primary tumour site.

The patient had been in the habit of chewing tobacco 8-10 times a day. After surgery patient reduced frequency of chewing tobacco (2 times a day) but could not quit the habit completely.

Intraorally, the mandibular residual alveolar ridge presented atypical anatomy with a healed, discontinuity defect on the right side, extending to the midline. Part of the tongue was also resected during surgery resulting in complete obliteration of lingual sulcus (on affected side) & severely

* BDS, MDS
† BDS

compromised tongue functions (speech & swallowing). Quality & quantity of saliva as well as the condition of oral mucous membrane was found to be normal.

Extra-oral examination revealed asymmetrical lip retraction and an angular path of closure with deviation of the mandible towards resected side (figure-1).

The main objectives for prosthetic rehabilitation were to achieve the optimum level of oral functions, especially mastication, swallowing & speech.

A tissue supported resection denture for the mandibule & a complete denture for maxillary arch was the final treatment option. Recent history of radiation therapy and uncertain prognosis of the lesion were most important reasons for not using dental implants[8, 9, 10, 11, 12, 13, 14, 15, 17, 18, 20, 21, 22].

A mandibular resection denture posed many challenges, especially due to its limited surface area, obliteration of the lingual sulcus, compromised tongue function & mandibular deviation on closure. Modifications to the typical procedure were undertaken to meet the specific challenges of this case.

Maxillary and mandibular diagnostic impressions were made using metal stock trays & irreversible hydrocolloid (Tropicalgin). The impression tray for the mandibular arch was modified by cutting away excess tray. Special trays were fabricated in the conventional manner and border moulding, and definitive impressions were made. The borders on nonresected side in mandibular arch were extended as much as possible, so that area covered by denture can be maximized to improve the retention and stability.

A neutral zone technique was considered the best means to determine the position of artificial teeth, soft-tissue contours and the polished surface of mandibular denture[22, 23, 24]. The neutral zone was recorded using red modelling plastic impression compound (Impression Compound). The compound occlusion rim was softened in the water bath of adequate temperature & patient followed a regimen of swallowing, sucking,[25, 26] and saying "ah, ee, oh" aloud [27]. This permitted the muscles to engage and adjust the compound occlusion rim intraorally. The patient was also instructed to move his cheeks, lips, and tongue continuously to assist in molding the compound material[28]. The compound was reheated in the water bath, and the procedure was repeated to confirm the shape of the neutral zone.

Jaw relation records were completed by recording the vertical dimension of occlusion and centric relation. The patient exhibited limited tongue mobility & was unable to contact the palate during swallowing. The vertical dimension of occlusion (VDO) was reduced so that tongue could contact the palate to assist swallowing[1]. The maxillary occlusion rim was made wider on nonresected side, to provide an occlusal ramp & to compensate for mandibular deviation (figure-2).

Non anatomic teeth were selected for both maxillary and mandibular denture. Artificial teeth were arranged within the confines of recorded neutral zone. Two rows of teeth were arranged on maxillary occlusion rims on the nonresected side, the outer row for aesthetics and cheek support and inner row, which acted as a ramp where mandibular denture teeth articulated with the maxillary denture on closure (figure-3) [29, 30].

Mandibular teeth were tilted lingually while maxillary teeth over the ramp were tilted buccaly, so that long axis of teeth & masticatory forces remain perpendicular to mandibular residual ridge during lingually inclined closure of residual mandible (figure-4).

Try in of the "wax up" denture was completed. During final preparation the maxillary denture was made hollow on the side where two rows of teeth were arranged by lost salt technique [1], thus reducing the weight of maxillary denture by about 20%. Denture delivery was completed after giving necessary instructions (figure-5). Few minor adjustments were made in prosthesis during six months follow up.

When adequate time has elapsed after radiotherapy and prognosis for neoplasm is established, the resection denture can be converted in an implant supported overdenture.

DISCUSSION

Discontinuity defect group includes mainly patients with a guarded prognosis for tumour control, precluding major reconstruction efforts. The prosthodontic prognosis depends on the number of complex factors[1, 29, 30]. Surgical defects extending to the midline have a poorer prosthetic prognosis than if resection is confined to molar or cuspid region. The status of the remaining tongue tissue is the most important prosthodontic prognostic indicator. Radiation therapy and scar contracture can further complicate the prognosis. Resection complete dentures for these patients are primarily for aesthetics & psychological comfort and often have very limited function.

Arrangement of teeth directly over the ridge crest can lead to denture instability in resection denture even more than in conventional dentures due to the atypical anatomy. Successful denture treatment in situations like this can become increasingly dependent on the position of the denture teeth and the external contours of the dentures. It is for these patients for whom the neutral zone concept becomes highly significant [22, 31].

Only the mandibular denture is modified for the neutral zone procedure, as presented. The neutral zone procedure is more beneficial to the mandibular denture, because many other factors favour the retention and stability of the maxillary denture, when compared with the mandibular denture [32, 33].

We feel that the vertical dimensions (VDO) should be reduced as much as possible in patients who exhibit reduced tongue bulk or compromised tongue mobility (particularly tongue elevation). Restoring the original vertical dimension of occlusion in these patients will prevent the tongue from effectively interacting with palate during speech & swallowing[1]. Another method to deal with limited tongue mobility can be to increase thickness of palatal surface of denture but this approach increases weight of maxillary denture. Denture's weight was itself a problem due to presence of palatal ramp & two rows of teeth, therefore reduction in VDO is recommended instead of thickening palatal flange.

Arrangement of artificial teeth requires some variation from conventional prosthodontic guidelines. The angular pathway of mandibular closure induces lateral forces on the denture, as long axis of the artificial teeth is no longer

Figure 1. *Mandibular discontinuity defect, completely edentulous maxillary arch*

Figure 2. *Maxillary occlusion rim made wider on resected side to provide an occlusal ramp*

Figure 3. *Maxillary waxed up denture with two rows of teeth*

Figure 4. *Lingual inclination of mandibular teeth & buccal inclination of maxillary teeth on ramp to negotiate mandibular tilting & angular path during mouth closure.*

Figure 5. *Postoperative view*

parallel to path of the mandibular closure. Long axis of the mandibular posterior teeth should be tilted lingually, so that angle of mandibular closure & long axis of artificial teeth remain parallel to each other (picture-4).

Interdisciplinary discussions between maxillofacial surgeon & prosthodontist before resection can be very helpful in limiting size of resection & preventing important anatomical structures from mutilation, thus significantly improving prognosis[34].

CONCLUSION

For the segmental mandibulectomy patient described in this report, properly fabricated conventional complete denture for maxillary & resection denture for mandibular arch provided comfort and sufficient function.

The variations such as use of neutral zone impression technique, reducing the vertical dimension of occlusion (especially if tongue mobility is limited), use of non anatomic teeth & tilting long axis of teeth to compensate for mandibular rotation suggested in the case report may provide a more stable and retentive resection denture for patients with segmental mandibular defects.

ADDRESS FOR CORRESPONDENCE

Dr. Prasoon Shukla, Senior lecturer, Dept. of Prosthodontics, Sudha Rustagi College of dental sciences and research, Faridabad, Haryana, India. Email: prasoonshukla_12@yahoo.co.in

REFERENCES

1. Beumer J, Curtis TA, Marunick MT. Maxillofacial Rehabilitation: Prosthodontic and Surgical Considerations. Ishiyaku Euroamerica Inc, St Louis, Tokyo, 1996; 90-169.
2. Watson RM, Welfare RD, Islami A. The difficulties of prosthetic management of edentulous cases with hemi-mandibulectomy following cancer treatment. *J Oral Rehabil* 1984;**11**:201-214.
3. Esposito M, Hirschn JM, Lekholm U. Biological factors contributing to failures of osseointegrated oral implants. *Eur J Oral Sci* 1998;**106**:721-764.
4. Jegoux F, Malard O, Goyenvalle E, Aguado E, Daculsi G. Radiation effects on bone healing and reconstruction: interpretation of the literature. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod*. 2010;**109**(2):173-184.
5. Visch LL, Van Wass MAJ, Schmitz PIM. A clinical evaluation of implants in irradiated oral cancer patients. *J Dent Res* 2002; **81**: 856-859.
6. Esser F, Wagner W. Dental implants following radical oral cancer surgery & adjuvant radiotherapy. *Int J Oral Maxillofac Implants* 1997;**12**:552-557.
7. Chopra S, Kamdar D, Tulunay Ugur OE, Chen G, Peshek B, Marunick M et al. Factors predictive of severity of osteoradionecrosis of the mandible. Head Neck. 2011 ;11: 1002 (Abst).
8. Keller EE. Placement of dental implants in irradiated mandible: A protocol without adjunctive hyperbaric oxygen. *J Oral Maxillofac Surg* 1997;**55**:972-980.
9. Keller EE, Tolman DE, Zuck SL. Mandibular endosseous implants & autogenous bone grafting in irradiated tissue: a 10-year retrospective study. *Int J Oral Maxillofac Implants* 1997;**12**:800.
10. Berger A, Bensadoun RJ. Cancer Radiother. *Normal tissue tolerance to external beam radiation therapy: the mandible*. 2010;**14**(4-5):295-300.
11. King MA, Casarett GW, Wwber DA. A study of irradiated bone I: Histopathologic & physiologic changes. *J Nucl Med* 1979; **20**:1142-1149.
12. Albrekttson T. A multicenter report on osseointegrated implants. *J Prosthet Dent* 1988; **60**:75-84.
13. Taylor TD, Worthington P. Osseointegrated implant rehabilitation of the previously irradiated mandible: results of limited trial at 3 to 7 years. *J Prosthet Dent* 1993; **69**:60-9.
14. Colella G, Cannavale R, Pentenero M, Gandolfo S. Oral implants in radiated patients: a systematic review. *Int J Oral Maxillofac Implants*. 2007;**22**(4):616-622.
15. Bodard AG, Gourmet R, Lucas R, Bonnet E, Breton P. Dental implants in irradiated areas: a series of 33 patients. *Rev Stomatol Chir Maxillofac*. 2006;**107**(3):137-142.
16. Garrett N, Roumanas ED, Blackwell KE, Freymiller E, Abemayor E, Wong WK et al. Efficacy of conventional and implant-supported mandibular resection prostheses: Study overview and treatment outcomes. *J Prosthet Dent* 2006; **96**:13-24.
17. Huang JW, Luo HY, Li Q, Li TJ. Primary intraosseous squamous cell carcinoma of the jaws. Clinicopathologic presentation and prognostic factors. *Arch Pathol Lab Med*. 2009;**133**(11):1834-1840.
18. Jerjes W, Upile T, Petrie A, Riskalla A, Hamdoon Z, Vourvachis M et al. Clinicopathological parameters, recurrence, locoregional and distant metastasis in 115 T1-T2 oral squamous cell carcinoma patients. *Head Neck Oncol*. 2010;**2**:9.
19. Marunick MT, Roumanas ED. Functional criteria for mandibular implant placement post resection and reconstruction for cancer. *J Prosthet Dent* 1999;**82**:107-113.
20. Keller EE, Tolman DE, Zuck SL. Mandibular endosseous implants & autogenous bone grafting in irradiated tissue: a 10-year retrospective study. *Int J Maxillofac implants* 1997;**12**:800.
21. Granstrom G. Placement of dental implants in irradiated bone: the case for using hyperbaric oxygen. *J Oral Maxillofac Surg* 2006; **64**:812-818.
22. Wee AG, Cwynar RB, Cheng AC. Utilization of the neutral zone technique for a maxillofacial patient. *J Prosthodont* 2000;**9**:2-7.
23. Patil PG. Conventional complete denture for a left segmental mandibulectomy patient: a clinical report. *J Prosthodont Res*. 2010;**54**(4):192-197.
24. Pekkan G, Hekimoglu C, Sahin N. Rehabilitation of a marginal mandibulectomy patient using a modified neutral zone technique: a case report. *Braz Dent J*. 2007;**18**(1):83-86.
25. Fahmy FM, Kharat DU. A study of the importance of the neutral zone in complete dentures. *J Prosthet Dent* 1990;**64**:459–462.
26. Beresin VE, Schiesser FJ. The neutral zone in complete dentures. *J Prosthet Dent* 1976;**36**:356–467.
27. Lott F, Levin B. Flange technique: An anatomic and physiologic approach to increase retention, function, comfort, and appearance of dentures. *J Prosthet Dent* 1966;**16**:394–412.
28. Razek MK, Abdalla F. Two-dimensional study of the neutral zone at different occlusal vertical heights. *J Prosthet Dent* 1981;**46**:484–489.
29. Scaff NG. Oral construction for edentulous patients after partial mandibulectomies. *J Prosthet Dent* 1969;**21**:197-202.
30. Rosenthal LC. The edentulous patients with jaw defects. *Dent Clin North Am*;964:**8**:773-779.
31. Sheppard IM. Denture base dislodgment during mastication. *J Prosthet Dent* 1963;**13**:462–468.
32. Jacobson TE, Krol AJ. A contemporary review of the factors involved in complete dentures, Part III: Support. J Prosthet Dent 1983;**49**:306–313.
33. Zarb GA, Bolender CL, Hickey JC. Biomechanics of the edentulous state. In Zarb GA, Bolender CL, Hickey JC (Eds): Boucher's Prosthodontic Treatment for Edentulous Patient. St Louis: Mosby, 1990; pp 3–27.
34. Rahn AO, Goldman BM, Parr GR. Prosthodontic principles in surgical planning for maxillary and mandibular resection patients. *J Prosthet Dent* 1979; **42**: 429-433.