EVALUATION OF MANDIBULAR RECONSTRUCTION TECHNIQUES FOLLOWING RESECTION OF BENIGN & MALIGNANT TUMOURS IN ORAL REGION

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CERTIFICATE

This is to certify that this dissertation titled "**EVALUATION OF MANDIBULAR RECONSTRUCTION TECHNIQUES FOLLOWING RESECTION OF BENIGN & MALIGNANT TUMOURS IN ORAL REGION"** is a bonafide record of work done by **Dr. M.SUGANTHI** under my guidance during her postgraduate study period between 2012-2015.

This dissertation is submitted to **THE TAMILNADU Dr. M.G.R. MEDICAL UNIVERSITY,** in partial fulfillment for the degree of **MASTER OF DENTAL SURGERY** in **Branch III – ORAL AND MAXILLOFACIAL SURGERY**.

It has not been submitted (partially or fully) for the award of any other degree or diploma.

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CONTENTS

Introduction

Mandibular defects occur as a result of loss of continuity of bone due to resection of benign or malignant tumours, trauma or inflammatory disease.[7] The mandible has to be reconstructed efficiently as unrepaired defects lead to severe facial disfigurement, loss of functions such as speech, chewing and swallowing and ultimately affect the patient's quality of life.[44]

But attaining good outcomes in mandibular reconstruction is usually challenging to a surgeon despite the huge developments in reconstruction techniques over a century. The reasons for the same are many. The mandible is the only load-bearing bone of skull and needs to withstand the forces transmitted through mastication. The goals of mandibular reconstruction are not only to re-establish the continuity of the mandible but also to restore function. The return of function includes speech, swallowing, and chewing.[47] In case of malignancy, the resection not only involves mandibular bone but also the adjacent soft tissues. This complicates the attempts at reconstruction which is further complicated by radiotherapy which is often necessary in cases of malignant tumours.[7]

The techniques of mandibular reconstruction have come a long way starting from the free bone grafts first used by German pioneers[7], through pedicled grafts, reconstruction plates, microvascular free flaps, particulate cancellous marrow grafts, modular endoprosthesis to the present day distraction osteogenesis[22] and tissue engineering techniques.[4]

The free bone grafts first used by Sykoff to reconstruct mandibular defect are still a good option for defects that are not bigger than approximately 5 cm, provided the soft tissues are in good condition.[7]

The reconstruction plates first used by Spiessl in 1979 which were made with the intention of bridging defects while stabilizing remaining segments and maintaining occlusion and facial contour are currently used to fix corticocancellous blocks or vascularized bone grafts to the remaining mandible.[7]

The pectoralis major myocutaneous flap introduced into head and neck reconstruction by Ariyan in 1979 raised the bar for head and neck reconstruction and still remains one of the most commonly used pedicled flap along with reconstruction plates for mandibular reconstruction in India owing to the advantages that this method of reconstruction offers such as lesser cost, simplicity of harvesting, proximity to head and neck or as a salvage surgery when free flap failure occurs.[5] The bulk of flap provides good contour when needed in reconstruction of massive soft tissue defects in cases of locally advanced disease. Several disadvantages of the flap such as reduced neck mobility, thickness of flap due to excess subcutaneous fat, complications like partial or complete flap necrosis, fistula formation, dehiscence, infection following radiotherapy had led to replacement of this workhorse flap by free flap reconstruction.[5]

The introduction of microvascular surgery by McKee through the use of a microvascular free rib graft for mandibular reconstruction in 1971 brought about a revolution in mandibular reconstructive surgery. At present, the donor sites used

most commonly for mandibular reconstruction are the radial forearm, scapula, iliac crest and fibula.[7]

Though the microvascular free flaps have a high success rate with advantages such as durable reconstruction, lengthy bone segment with possibility of placing implants and are usually unaffected by radiation therapy the certain disadvantages such as high cost, technique sensitivity, requirement of special armamentarium and lack of bone height in certain free flaps with donor site morbidity has made surgeons to think over use of free flaps in certain situations.[13]

Though the above mentioned techniques are widely used in practice and the techniques of tissue engineering and distraction osteogenesis are slowly developing, no ideal solution for replacing form and function of mandible through mandibular reconstruction has been found.[7]

Earlier studies on different techniques of mandibular reconstruction namely microvascular free flap with reconstruction plate, pectoralis major myocutaneous flap used with reconstruction plate or use of reconstruction plate alone have shown that each of the techniques have their own advantages and disadvantages in terms of physical and functional outcome. Only few of the studies have been conducted to analyse the outcome of reconstruction on patients based on the various day to day activities performed by them.

Although the primary intended outcome of surgery to treat head and neck tumours is disease-free survival of the patient, health-related quality of life is now seen as an essential outcome. It is becoming increasingly important and is a global

construct that reflects the patient's general sense of well-being. It is by definition multi-dimensional and reflective of the patient's point of view.[24] It is particularly important for head and neck patients because social interaction largely depends on integrity of head and neck region.[17]

Aims & Objectives

The aim of this study is to retrospectively analyze the patients who underwent different mandibular reconstruction techniques like reconstruction plate only, reconstruction plate with pectoralis major myocutaneous flap and reconstruction plate with microvascular free flap following resection of benign and malignant tumours at our institution and to evaluate their quality of life based on important factors such as facial appearance, swallowing, tolerance of diet, speech and activity and to analyse the postoperative complications associated with these reconstruction techniques.

The study also analyses the associated factors such age, type of tumour, type of mandibular defect and adjuvant radiotherapy in influencing the postoperative complications and quality of life of patients undergoing mandibular reconstruction.

Review of literature

Jewer et al (1989)[23] reviewed 60 patients who underwent orofacial and mandibular reconstruction with iliac crest free flap and proposed a classification of mandibular defects known as the HCL classification to reflect complexity of reconstructive problem rather size of the reconstruction alone. 'C' defects involve entire symphyseal area including both lower canines, 'L' defects are lateral defects not including condyle and 'H' defects are lateral defects which include condyle.

Boyd JB et al (1993)[8] modified the classification given by Jewer et al to overcome difficulties in classifying the mandibular defects when there was a skin or mucosal defect. The classification is based on 3 upper case and 3 lower case characters: H, C, L and o, m, s. H are lateral defects of any length including condyle but not significantly crossing midline; L defects are the same but without the condyle and Cdefects consists of entire central segment containing 4 incisors and 2 canines. Combination of these letters are also possible. The letters 'o' indicate neither a skin nor mucosal component,'s' for skin, 'm' for mucosa and 'sm' for skin plus mucosa.

Donald A.Curtis et al (1997)[15] compared the oral function in terms of bite force assessed at first molar and incisor region, tongue and cheek function and patient reports of tolerance of diet among 10 patients with reconstructed mandible, 10 patients without reconstruction of mandibular defects and 10 controls. The reconstruction group patients had decreased biting force, more restricted diet and

compromised cheek and tongue function than the control group but had better results for the same than the non-reconstructed group.

K.R.Spencer et al (1999)[25] retrospectively analyzed 21 patients who underwent primary mandibular reconstruction with titanium reconstruction plates following ablative surgery for advanced malignant tumours where sophisticated reconstruction techniques were deemed appropriate. They found the overall success rate to be 71% over a follow-up period of 7 to 53 months. The failure rate was high in patients who were subjected to radiotherapy (63%) and in patients with large central (100%) and combined central and lateral defects of mandible (100%) . They concluded that the reconstruction plates can be palliatively used for bridging lateral segmental mandibular defects in patients unsuitable for other reconstruction techniques.

David A.Hidalgo et al (2002)[12] retrospectively analyzed 20 patients who underwent free flap reconstruction after mandibular resection and at 10 year follow up found that the functional and esthetic results remain stable (95%) with minimal bone resorption (8%) even in cases of postoperative radiation therapy with most of the patients tolerating regular diet(70%) and had dental rehabilitation(55%) with acceptable speech and appearance. They concluded that the functional and esthetic results correlate more with extent of soft tissue defect than with the extent of bone defect.

Raphael Lopez et al (2004)[45] retrospectively analyzed 34 patients who underwent mandibular reconstruction with titanium functionally dynamic bridging plate system and found that at the end of mean follow-up period of 19 months, the success rate was 53% with 1 plate exposure (2.9%) and 1 plate fracture (2.9%) requiring surgical management. The esthetic results were good or acceptable in 79% cases while the functional results were satisfying. They concluded that the reconstruction plating technique still remains a viable and acceptable option for patients who are unable to undergo other complex reconstruction techniques.

Masaya Okura et al (2005)[32] retrospectively analyzed 100 patients who underwent immediate bridging plate reconstruction mandible with a median follow-up of 70 months. Soft tissues defects were closed with various microvascular myocutaneous flaps in 34 cases and primary closure was obtained in 29 cases. The 5 year plate survival rate was 62.2% with complications in 34 cases (34%). Intraoral exposure(6%) was early complication while screw loosening (7%) and plate fracture (6%) were late complications with extraoral exposure(14%) being intermediate. Anterolateral defects and preoperative radiotherapy were found as adverse factors for patients with lateral mandibular defects and no preoperative irradiation in whom longer operating time and blood transfusion is not feasible.

P.Salvatori et al (2007)[38] retrospectively analyzed 27 patients who underwent mandibular reconstruction with locking-screw titanium plates and pectoralis major myocutaneous flaps. Over a follow-up period of 13 months, they found plate exposure occurred in 6 of the 12 patients who were alive (22%). 2

patients required plate removal and 2 patients underwent successful recoverage while 2 patients died with plate exposure. The overall success rate was 85%. Though the esthetic outcome was found acceptable by most patients, the inability to have dental rehabilitation , left the patients unsatisfied. Plate exposure was greater in symphyseal defects(40%) followed by posterolateral defects (12%). They concluded that bridging plates can be used for reconstructing mandible provided plate is adequately covered by viable tissue preferably of muscular nature and can be offered to patients contraindicated for more invasive procedures or with limited functional needs or have poor prognosis.

Zubing Li et al (2007)[56] retrospectively reviewed 242 patients who underwent mandibular reconstruction by 6 grafting techniques namely free autogenous bone transplant, frozen autogenous lesioned mandible, frozen autogenous lesioned mandible – iliac/rib compound, vascularized auotgenous bone transplant, homologous bone transplant and hydroxyapatite /titanium reconstruction plate. The functional and esthetic results were found to be good in 83.8% of patients with serious postoperative complications occurring in 10 patients (4.13%) and no statistically significant difference between groups. They concluded that autogenous bone graft was the best reconstruction technique for smaller defects while frozen autogenous lesional mandible plus autogenous iliac or rib graft can be recommended for larger defects. Strict patient selection, careful surgical procedure with good perioperative nursing care were found to be key factors for success.

A.C.Hundepool et al (2008)[1] evaluated 24 patients who underwent segmental mandibular resection and reconstruction with osteocutaneous free fibula flap and dental rehabilitation for clinical and functional assessment, quality of life and denture satisfaction. The most frequent reason for a lower rate of dental rehabilitation(25.7%) was found to be poor survival rate of patients (62.8%). The benefits of dental rehabilitation either with implant retained denture or fixed appliance was more in terms of cosmesis than oral function.

Alan S.Herford et al (2008)[4] prospectively analyzed 14 patients who underwent reconstruction of body and angle of mandible with 4-8 mg of Bone Morphogenic Protein (rhBMP-2) in concentration of 1.5 mg per cc of defect delivered to surgical site in a collagen carrier and found that the bone formation was clinically and radiographically appreciable at 4 months and 6 months respectively. They concluded that the cytokines especially rhBMP-2 can be used for reconstruction of critically sized mandibular defects without concomitant use of bone grafting materials.

David D. Vu et al (2008)[13] performed quality of life evaluation on 18 patients who underwent mandibular reconstruction with vascularised free fibula flap and non-vascularized iliac crest bone graft to conclude that the patients with iliac crest bone graft had better function such as chewing (P= 0.04), swallowing (P=0.049) and taste (P=0.067). The comparison between irradiated and non-irradiated patients showed that non-irradiated patients had improved swallowing (P=0.07) and chewing (P=0.094) with significant difference in salivary flow

(P=0.038). They suggest that the iliac crest reconstruction should be considered when there is appropriate defect size and no radiotherapy.

David L.Hirsch et al (2008)[14] compared the outcomes of mandibular reconstruction with microvascular free flaps in patients who underwent excision due to osteoradionecrosis and in patients without osteoradionecrosis. The comparison between 3 groups namely patients with osteoradionecrosis and history of irradiation, patients with osteoradionecrosis but history of irradiation and patients with no osteoradionecrosis or irradiation showed the overall flap survival rates to be 86%, 87% and 90% respectively. The overall complication rate was 50% with skin necrosis and carotid blowout (2.9%) unique only to ORN group. They suggested that the osteocutaneous fibula free flap would be preferred choice for reconstruction in osteoradionecrosis patients with regional soft tissue flaps reserved for salvage procedures.

Koord Smolka et al (2008)[27] retrospectively analyzed 56 patients in whom a systematic combined surgical and prosthodontic treatment approach was used for dental rehabilitation following mandibular reconstruction with fibula free flap. They found that the early complications were observed in patients who had been irradiated and the dental implant survival rate was 92%. The complete dental rehabilitation was done only in 42.9% cases owing to poor patient cooperation and tumour recurrence. They suggested that the complete dental reconstruction can be achieved in these patients if systematic combined concept is carried out though poor patient cooperation and tumour recurrence playing a minimal role for failure.

Krishnakumar Thankappan et al (2008)[28] reported the use of 3 – dimensional CT based reconstruction of neomandible to assist in contouring of reconstruction plate and harvested free fibula in 4 cases and concluded that this technique allows for planning and execution of osteotomies to obtain an ideal contour in cases of absent or distorted mandible with good esthetic and functional results.

Todd G.Carter et al (2008)[51] evaluated 5 patients who underwent mandibular reconstruction with rh Bone Morphogenic Protein-2(rh BMP-2) soaked collagen alone or in combination with bone marrow cells and allogenic cancellous bone chips and found that in 3 out of 5 patients bone formation was revealed clinically and radiographically and 2 patients had failure. They concluded that defects in mandibular bone can be successfully reconstructed using tissue engineered osteoinductive grafts.

D.P.Coletti et al (2009)[11] retrospectively analyzed patients who underwent mandibular reconstruction with second generation locking reconstruction plates for complications and risk factors and concluded that the locking reconstruction plates had a complication rate of 36% and average time of implant failure was 14 months. The primary vascularized bone reconstruction was found to be a better option as it provides osseous support to plate for load bearing and soft tissue support for preventing plate exposure.

Mohamed A.F.El-Zohairy et al (2009)[34] reviewed 33 patients who under mandibular reconstruction using pectoralis major myocutaneous flap and titanium plates following ablative cancer surgery. The 72.7% patients underwent post-op radiation. The overall flap survival rate was 100% with partial flap necrosis in 3 patients (9.1%), plate exposure in 3 patients (9.1%) and plate fracture in 1 patient (3.03%) The satisfactory results were observed in 87.9% cases. They concluded that bridging titanium plates covered by healthy myocutaneous flap is a reliable and effective method of reconstruction in high risk patients with advanced cancer and uncertain long-term survival.

Peter Maurer et al (2009)[40] retrospectively reviewed 102 patients who underwent mandibular reconstruction with titanium reconstruction plates in 73 cases and with miniplates in 29 cases. Free autologous bone graft was used in all 29 cases of miniplates and in 9 cases of titanium reconstruction plates. The overall 1 year success rate was 64% with 66% for miniplate group and 63% for plate group. Complications were observed in 39% of plate cases with intraoral /extraoral exposure, fracture and screw loosening being most common. The risk of reconstruction plate failure was significantly higher in patients male patients and smokers. Radiation also reduced success rate from 64% to 45%. There were no significant difference between reconstruction methods.

Raul Gonzalez – Garcia et al (2009)[46] analyzed 97 patients who underwent free fibula flap and radial forearm free flap and found that results were esthetically good in 90.47% and 84.6% patients respectively with few donor site

complications. They concluded that the radial forearm free flap can be used to reconstruct soft tissue defects of oral cavity while free fibula flap can be used to reconstruct mandibular defects with successful placement of osseointegrated implants for better results.

Y.Matsui et al (2009)[54] demonstrated that mandibular reconstruction can be done using 2 step bone transport in a patient who had undergone irradiation preoperatively and is a known type II diabetic under medication in whom immediate free flap reconstruction was a failure. A length of 90 mm of mandible was achieved with distraction and bone height good enough to receive 3 implants that were placed 21 months after first distraction and 14 months after second distraction. The bone and implants remained stable for more than 2 years after loading. They concluded that the distraction osteogenesis is possible even in irradiated patients with diabetes although a long treatment period is required.

Akira Matsuo et al (2011)[3] evaluated the use of particulate cancellous bone and marrow and platelet rich plasma along with autonomous thrombin delivered in titanium mesh or tray in 16 patients and delivered in a cortical crib in 2 patients for mandibular reconstruction. They also compared the intraoral and extraoral approaches used and found that the intraoral approach had complication rate of 30% while extraoral group had none. But there was no significant difference in bone formation in both groups. They concluded that this method of reconstruction was safe and reliable in cases of benign tumours and trauma with use of any one of the approaches.

Chih-Yu Hsing et al (2011)[10] retrospectively analyzed 100 patients who underwent reconstruction with free flap and pectoralis major pedicled flap and found that significant difference was found in speech, shoulder and mood domains among 2 groups and chewing, swallowing, speech and pain were the most concerned domains by patients.

Eyituoyo et al (2011)[17] assessed quality of life (QoL) in 13 patients who underwent segmental mandibular resection due to benign pathologies followed by immediate reconstruction with plates. The patients were followed for a minimum of 6 months. The mean QoL scores showed that patients below 20 years (91.1), patients with anterior segmental defects (92.5), patients with defects less than 10 cm (87.0), patients with recovery time greater than 14 months (83.9), patients with shorter recovery time (80.7) had greater scores for QoL than their respective counterparts. They concluded that several factors coexist to result in better QoL.

Neelam N.Andrade et al (2011)[37] reported the use of bifocal and trifocal transport distraction osteogenesis as primary mode of mandibular reconstruction in 2 patients. The amount of bone formation was 51 mm and 73 mm in the 2 cases with few complications. They found the transport distraction osteogenesis to be a viable option for reconstruction with decreased treatment cost.

Qilong Wan et al (2011)[42] evaluated and compared the health-related quality of life (HR-QoL) in patients who underwent different types of mandibular reconstruction techniques such as free bone graft (FBG), particulate bone cancellous

marrow graft (PBCMG), reconstruction plate (RP) and microvascular free flap (MVFF) using University of Washington Head and Neck Quality of Life Questionnaire. Appearance, chewing, activity, appearance-donor site, function-donor site were the frequently chosen domains by patients as the most important issues. The HR-QoL and overall QoL were rated as good in FBG and PBCMG group while it was good in RP and MVFF groups. There was no significant difference between FBG and PBCMG group while RP group had the lowest mean scores for the domains. The most important domains in FBG and PBCMG group were appearance (60%), chewing (60%) and activity (42.4%) while in RP group and MFF group it was appearance (76.2%), chewing (54.8%) and speech (35.7%). The comparison of HR-QoL between these groups can be used as a predictor for treatment outcomes which help the surgeon to choose the optimal reconstruction technique.

Qu Xingzhou et al (2011)[43] reported the use of deep circumflex iliac artery (DCIA) flap combined with a costochondral graft for reconstructing mandible after resection due to benign tumours in 5 cases. A prefabricated 3D model was made to aid in accurate contouring of plates and planning of size of bone graft. The DCIA flap is first harvested and adapted to the precontoured plate. Later the costochondral graft is harvested and adapted to the iliac graft and plate before insertion into defect. The combined approach had shown good contour and symmetry of reconstruction with enough bone height to receive implants in 4 cases and good mandibular function and TMJ function in all 5 cases.

Bartaire et al (2012)[6] analyzed 23 recurrence free squamous cell carcinoma patients who underwent mandibular reconstruction with free fibula flap and found that the patient satisfaction rates of morphologic assessment of recipient (74%) and donor site (70%) were high compared to that of experts (47% and 57%). The functional assessment of donor site revealed non-negligible impact on donor site but was well-supported by patients.

Florian Andreas Probst et al (2012)[18] evaluated the treatment outcomes of MatrixMANDIBLE Preformed Reconstruction Plates (MMPRP) which have bendable proximal and distal parts and non-bendable center. In 10 out of 70 patients, transoral approach was used and mean contouring time was 13.1 minutes. Postoperative complications such as plate exposure and osteocutaneous fistula formations occurred in 27% of patients who were mostly irradiated. Plate removal was required in 15.7% of patients. They suggested that the use of these modified plates result in lesser operative time and minimization of risk of fatigue fractures and can be feasible even in a transoral approach and for anterolateral defects.

Gilles Guerrier et al (2012)[19] retrospectively analyzed 35 patients who underwent mandibular reconstruction with iliac crest bone graft following war injuries and found that after a mean follow-up period of 17 months, bony union was achieved in 80% of cases and bone quality was adequate to receive implants in 66% of cases. Plate exposure and fracture occurred in 2 cases with development of seromas in donor site in 5 cases. They concluded that the non-vascularized bone grafts can be used for reconstructing mandible in war injuries as multistage

procedures provided the soft tissues are in good condition and in absence of infection.

J.j.Wang et al (2012)[22] reported the use of double step transport disc distraction osteogenesis (TDDO) in mandibular body and ramus for reconstruction of unilateral mandibular segmental defects using internal distraction devices in six patients. The esthetic and functional results were excellent with satisfactory dental rehabilitation following placement of osseointegrated implants. The double-step TDDO is found to be a reliable method of mandibular reconstruction through the overall treatment time is prolonged.

Larissa Sweeny et al (2012)[29] compared the outcomes of microvascular free flap with or without use of rhBMP-2 who underwent resection due to refractory osteoradionecrosis. The rhBMP-2 was placed in between the osteotomy sites of native mandible and bone graft. There was no statistically significant difference between the rhBMP-2 group (8 cases) and non-rhBMP-2 group (9 cases) in terms of flap survival or complication rates in this study though the trends suggested that use of rhBMP-2 would result in better outcomes and lesser complications.

N. Zwetyenga et al (2012)[36] retrospectively analyzed 14 patients who underwent distraction with bone transport for reconstruction of large mandibular and soft tissue defects and found the average mandibular bone reconstruction to be 13.6 cm with mean duration of distraction of 2.3 months. 2 patients had non-union and were treated with iliac bone graft. 57% of patients were rehabilitated with dental

implants with 95.5% success rate. They recommended the transport distraction osteogenesis for patients with severe lower face defect to achieve acceptable appearance and reasonable quality of life.

VN Okoje et al (2012)[52] retrospectively analyzed 47 patients who underwent iliac crest bone graft reconstruction of mandibular defects due to resection of benign tumours or trauma and found that the appearance was satisfactory in 89.4% of patients and graft infection (21.3%) occurred in 10 patients. The comparison between methods of fixation such as transosseous wires and titanium plates revealed that infection occurred only in wire group. Six (60%) out of ten infected cases required graft removal while 4 were successfully treated for infection. They concluded that the non-vascular iliac crest bone graft can be used as successful, affordable and less technical choice of reconstruction in less economic patients and defects due to benign tumour or trauma.

Yi Shen et al (2012)[53] retrospectively analyzed 10 patients who underwent extensive mandibular reconstruction in the symphysis region with or without condylar prosthesis using partial double-barrel vascularized fibula graft and found that bony union and wound healing was achieved in all patients during 43 months. The preoperative and postoperative chin-labial angle and bone height were not significantly different at end of 2 year follow-up and facial appearance was found to be excellent or good in 8 patients. They concluded that partial double-barrel vascularized fibula graft can be used for reconstruction of large mandibular defects

in symphysis region to achieve good facial appearance and function with good stability of soft and hard tissue.

Zachary S.Peacock et al (2012)[55] described a novel technique using custom prostheses to repair fractured mandibular reconstruction plates in 3 patients who were unable to undergo autogenous bone grafting procedures or replacement of entire plate due to medical or socioeconomic factors. The custom prosthesis is designed by 3D virtual planning software. Initially the portion of reconstruction plate on native mandible is subtracted and later a custom prosthesis is constructed to adapt to the buccal surface of mandible with an extension of female part which receives the end of old titanium plate. The fixation is done by locking screws in between the plates and by screws inserted into radial patterned slots in the distal segment of the prosthesis. They found that this method served as permanent solution to the problem of plate fracture.

Emeka Nkenke et al (2013)[16] demonstrated that the bony microvascular reconstruction following segmental mandibulectomy due to ameloblastoma can be achieved using an intraoral microvascular anastomosing technique. The arterial and venous anastomoses was achieved using intraoral vertical incision of buccal mucosa placed taking parotid duct as a guide. They recommended intraoral approach for microvascular flap reconstruction for segmental defects should be considered always if feasible.

Hitoshi Yoshimura et al (2013)[21] reported the use of iliac crest bone graft and greater auricular nerve graft for reconstructing mandible after segmental resection due to ossifying fibroma using temporal, submandibular and intraoral approaches. The greater auricular nerve graft was obtained from same side using submandibular approach. The nerve was sutured to the proximal and distal cut ends of inferior alveolar nerve using 10-0 nylon under surgical microscope. The iliac crest graft was fixed using miniplates to native mandible. The postoperative follow up showed that there was sufficient consolidation of grafted bone to receive two implants at 7 months postoperatively. There was return of sensation to lower lip and chin with pulpal sensitivity of teeth on surgical side. The patient had good esthetic outcome and functional recovery.

Juanfang Zhu et al (2013)[24] retrospectively analyzed 25 young patients with mean age of 35.5 years who underwent primary mandibular reconstruction with free fibula flap for assessing qulatiy of life and found that among various domains in University of Washington QoL questionnaire, appearance (72%) was the most concerning for most patients with best scores. Chewing (56%) and anxiety (52%) domains had lowest scores. In Medical Outcomes Study short form- 36 questionnaire, the best scoring domain was physical functioning (77.3 points) followed by bodily pain (74.56 points) and general health (72.56 points). They concluded that the postoperative facial appearance was the most concerning factor for young patients and it should be considered in surgical planning.

K.Yagihara et al (2013)[26] prospectively evaluated the stability and viability of mandibular bone regeneration using a poly L-lactide (PLLA) mesh tray and autogenous particulate cancellous bone and marrow (PCBM) in 62 patients who underwent mandibular resection due to benign and malignant tumours, cysts, Osteomyelitis or trauma and found the success rate to be 84% with a mean follow-up period of 88.2 months. They concluded that this method was stable and effective due to favourable morphological and functional recovery with low invasiveness. They proposed the technique as an alternative procedure for mandibular reconstruction as the regenerated bone showed low incidence of resorption over long term follow-up.

M.W.Ho et al (2013)[31] introduced a method for intraoperative temporary fixation for primary reconstruction of composite mandibular ablative defects. The technique involves use of a long (40 hole) miniplate which is bent into the shape of bucket handle and fixed with 2-3 screws on both sides of the bony resection margins. Marker sutures were placed to mark orientation of plate. The shape of the plate gives greater room for fashioning the free flap to reconstruct the defect and fixing the free flap by use of miniplates. The temporary long miniplate can then be removed. The advantages of this technique are minimal periosteal stripping of flap since miniplates are used and the shape of the temporary plate allows use of reconstruction plate in cases with ballooning of buccal or labial cortex.

N.Parbo et al (2013)[35] retrospectively analyzed 36 patients who underwent mandibular reconstruction with free fibula flap and found that the survival rate of graft was 97% over a mean follow-up period of 22 months and the rate of

dental rehabilitation was about 50% with implant survival rate of 96%. Non-severe complications were seen in 50% of patients. Death was the main reason for lack of prosthetic rehabilitation. They concluded that fibula graft with implant-supported prosthesis had high survival rates and few complications.

Praveen Sharma et al (2013)[41] reported spontaneous mandibular regeneration in 4 children who were treated with resection of mandibular bone due to benign tumours. The spontaneous regeneration was detected clinically and radiographically between 3 and 5 months after resection eliminating the need or atleast decreasing the size of the bone graft needed for reconstruction. The spontaneous regeneration was thought to be due to the intact periosteal layer which could provide osteogenic progenitor cells with good vascular supply and also preventing soft tissue prolapse. The age of the patients (6 – 12 years) was also thought to be influential.

T.J.Verhoeven et al (2013)[50] introduced a new method to quantify soft tissue facial asymmetry in patients who underwent mandibular reconstruction using 3D photographs obtained using stereophotogrammatrical camera. The comparison between 3D photographs of 5 patients and 5 controls revealed a significant difference of 1.19 mm in asymmetry between patients and controls. They concluded that this method to be a valid, fast and clinically acceptable technique for assessing facial asymmetry.

A.M.Fry et al (2014)[2] developed a new technique for creating intermaxillary splint and positioning stents to guide mandibular reconstruction. The positioning stent is formed by by using thermoforming plastic vacuum-formed over cast made from impression made after prebent reconstruction plate was adapted to 3D model by wax. The intermaxillary splint is formed from preoperative upper and lower models and bite registration done in wax to record occlusion. The splint holds the remaining mandibular segments in correct occlusal relationship with maxilla while the stent is used as guide to place the plate in desired position.4

Carlos Navarro Cuellar et al (2014)[9] described a mandibular reconstructive technique used in 12 patients which consisted of iliac crest free flap, nasolabial flap and osseointegrated implants for bone augmentation, soft tissue defect closure and dental rehabilitation respectively performed as a single procedure. The functional and esthetic results were excellent with 95.2% success rate for implants. Failure was associated with irradiated patients only.

Harry R.F.Powell et al (2014)[20] retrospectively analyzed 10 patients who underwent free fibula flap reconstruction following resection due to osteoradionecrosis. The amount of bone resorption or formation was measured at 25, 50 and 75% of distance along bone graft in series of rotational radiographs taken from 5 months to 20 months. Reduction of bone height was seen in 8 cases with mean value of 1.5 mm while increase in bone height was seen in 2 cases. It has been suggested that radiation before surgery causes increased resorption of fibular bone after reconstruction. The increase in bone height was explained by two theories. First

as a result of periosteal thickening along full length of bone due to periosteal stripping and subsequent inflammation. Second as a result of the potential for callous to form at the osteotomy sites.

Lidiya Zavalishina et al (2014)[30] retrospectively analyzed 11 patients who underwent free fibula flap reconstruction after segmental resection for assessing their quality of life using questionnaire and simultaneously evaluated the esthetic outcomes using patients' photographs which were assessed by two dental professionals using visual analog scale. They found that though there was a low correlation between patient and expert assessment, most of the patients rated their overall QoL as outstanding, very good or good (72.7%).

S. Arun Paul et al (2014)[48] assessed the outcome of 32 patients who underwent mandibular reconstruction with titanium reconstruction plate following resection due to jaw pathologies and found that the success rate was 94% with plate exposure occurring in 2 cases(6.3%) requiring its removal(6.3%). They concluded that the titanium reconstruction plates can be used for mandibular reconstruction provided the soft tissue provides sufficient bulk.

Si-Lian Fang et al (2014)[49] reviewed 12 instances of exposure of reconstruction plates which were treated with extended vertical lower trapezius island myocutaneous flaps to cover exposed areas of plate intraorally, extraorally or intra and extraorally. The flap was found healthy in all cases over mean follow-up period of 22.8 months with exposure of plate extraorally in only one patient. They

concluded that extended vertical lower trapezius island myocutaneous flaps can be used reliably to cover plates exposed intraorally, extraorally or both intra and extraorally.

Material & Methods

STUDY DESIGN:

The data of 18 patients who underwent mandibular reconstruction using reconstruction plate, reconstruction plate and pectoralis major myocutaneous flap and reconstruction plate and microvascular free flap following resection of benign and malignant tumours were analyzed. The quality of life and postoperative complications of these patients were assessed. All patients were treated at Sri Ramakrishna Dental College and Hospital, Coimbatore.

MATERIAL:

The records of all patients who underwent mandibular reconstruction between October 2009 to April 2014 were systematically reviewed. 82 patients were treated with resection of mandible due to benign and malignant tumours. Out of 82, 32 patients underwent reconstruction with reconstruction plate. Of these only 18 patients were taken up for study as the others were either deceased or unavailable for follow-up. These patients had undergone mandibular reconstruction with reconstruction plate only or reconstruction plate and pectoralis major myocutaneous flap or reconstruction plate with microvascular free flap.

INCLUSION CRITERIA:

1. Patients who underwent mandibular reconstruction with reconstruction plate only with primary closure following resection due to benign and malignant tumours.
2. Patients who underwent mandibular reconstruction with reconstruction plate covered with pectoralis major myocutaneous flap following resection due to benign and malignant tumours.
3. Patients who underwent mandibular reconstruction with reconstruction plate covered with microvascular free flap following resection due to benign and malignant tumours.
4. Isolated mandibular resection.
5. Patients who underwent neoadjuvant and adjuvant radiotherapy.

EXCLUSION CRITERIA:

1. Patients who developed locoregional recurrence of the tumour.
2. Patients who developed secondary tumours.
3. Patients who were medically compromised.
4. Patients unwilling to participate in the evaluation.

METHODS OF EVALUATION:

The patients taken up for study were asked to fill the subjective Quality of life Questionnaire which was prepared by modifying University of Washington- Quality of life questionnaire. The patients had a minimum of 6 months postoperative recovery period before participating in the study. The quality of life was assessed using questionnaire in terms of facial appearance, swallowing, tolerance of diet, speech and activity.

Facial appearance was the major concern for patients and was classified as:

1. Good
2. Satisfied
3. Acceptable
4. Dissatisfied

Difficulty of patients to swallow liquid and solid foods was classified as:

1. Good
2. Mild difficulty
3. Moderate difficulty
4. Severe difficulty

The type of diet tolerated by patient was classified as:

1. Normal diet
2. Semisolid diet
3. Liquid diet

The ability of patient to speak was classified as:

1. Normal
2. Easily understandable
3. Difficult to understand
4. Poorly understood

The ability of patients to carry out their daily activities was classified as:

1. Normal
2. Moderately active
3. Minimally active

The quality of life of patient was given as good, fair, acceptable and poor based on the total score obtained from the questionnaire.

The incidence of postoperative complications following reconstruction were also noted:

1) Infection – recipient site, donor site
2) Wound dehiscence
3) Flap necrosis
4) Fistula formation
5) Plate exposure
6) Plate removal
7) Derangement of occlusion
8) Pain/tenderness in TMJ
9) Deviation in mouth opening

STASTICAL ANALYSIS:

Statistical analysis was done using Chi-square test, students‘t’ test, Mann Whitney U test and Kruskal Wallis test. Statistical significance was defined as $P < 0.05$.

Figures

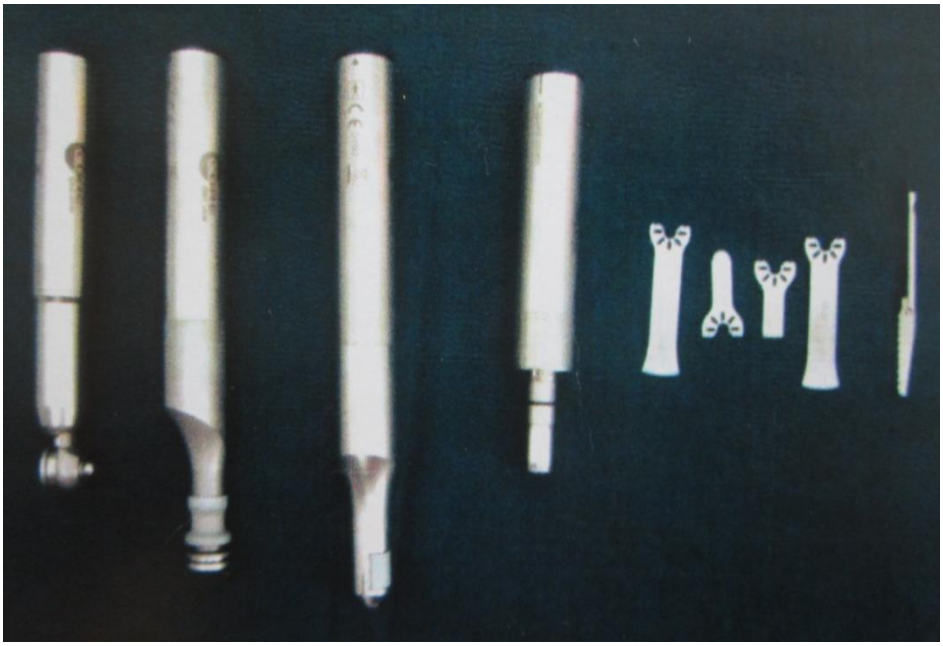

Figure 1: Armamentarium used for resection and reconstruction of mandible

Figure 2: Preoperative photographs of patient with ameloblastoma of left mandible

Figure 3: Intraoperative photographs of reconstruction with reconstruction plate only after left marginal mandibulectomy

Figure 4: Postoperative photographs of the patient after mandibular reconstruction with reconstruction plate alone after 6 months

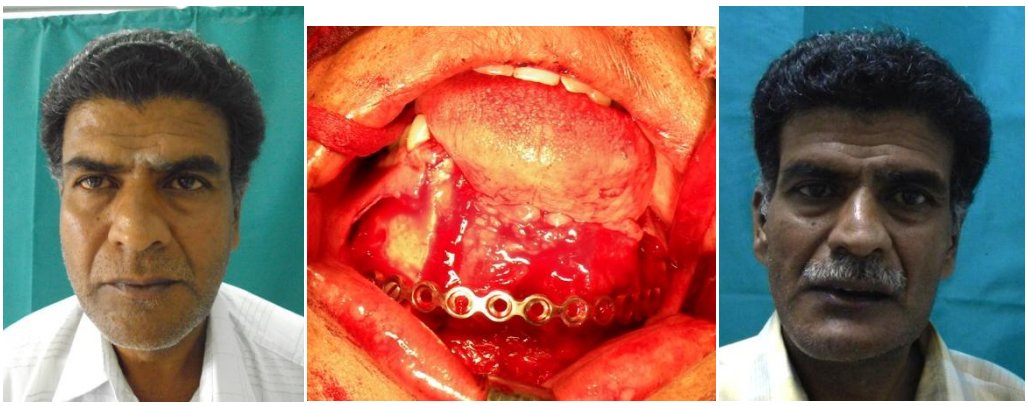

Figure 5: Preoperative, Intraoperative and Postoperative photographs (1 year) of a patient with mandibular reconstruction using reconstruction plate alone after resection due to ameloblastoma

Figure 6: Preoperative photographs of patient with carcinoma of right retromolar trigone

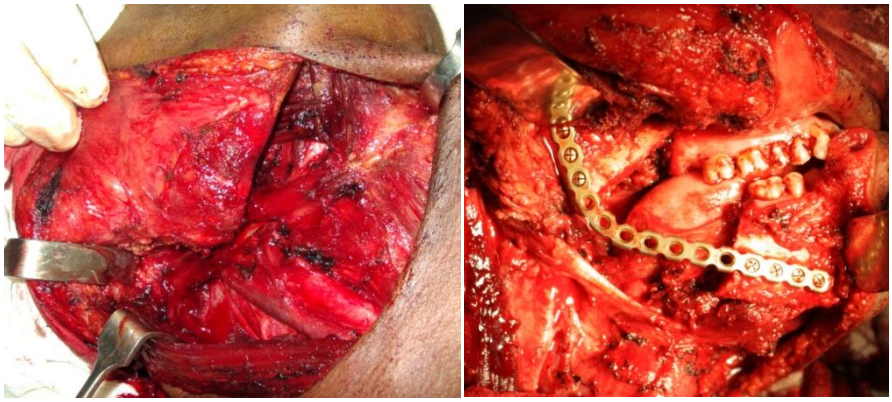

Figure 7: Right composite resection (segmental mandibulectomy with type III modified radical neck dissection) done and adaptation of reconstruction plate

Figure 8: Harvesting of pectoralis major myocutaneous flap and insertion into defect wrapping reconstruction plate followed by closure of recipient and donor sites

Figure 9: 2 year postoperative photographs of the patient

Figure 10: Postoperative photographs of patients treated with pectoralis major myocutaneous flap and reconstruction plate

Figure 11: Preoperative photograph of patient with ameloblastoma of right mandible

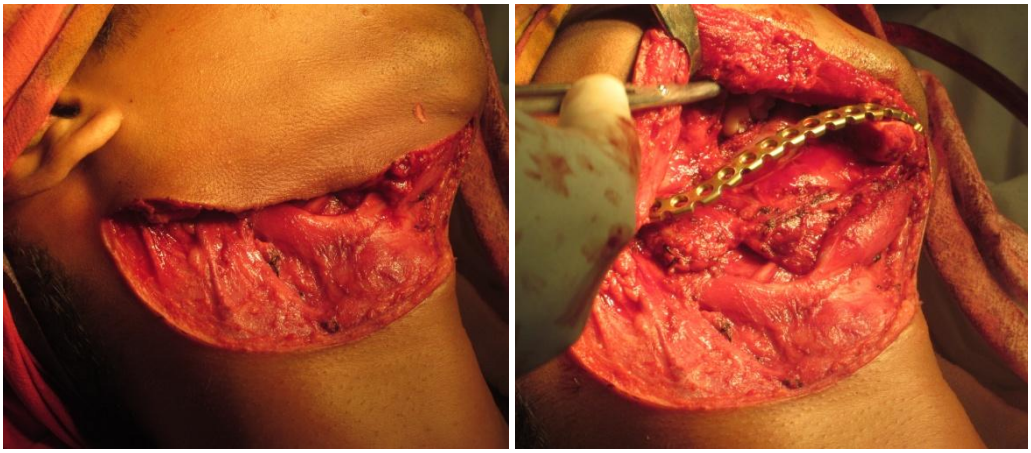

Figure 12: Hemimandibulectomy performed followed by fixation of reconstruction plate

Figure 13: Harvesting of free fibula flap from right leg followed by insertion and closure of donor and recipient site

Figure 14: 2 year postoperative photographs of patient after reconstruction with free fibula flap and reconstruction plate

Figure 15: Postoperative photographs of patients treated with microvascular free flap and reconstruction plate

Figure 16: Gastric tube for feeding in a patient

Figure 17: Presence of orocutaneous fistula with exposure of reconstruction plate

Figure 18: Hematoma formation followed by infection in recipient site

Figure 19: Wound dehiscence

Results

A retrospective study was conducted on quality of life and postoperative complications in 18 patients who underwent mandibular resection due to benign and malignant tumours followed by reconstruction with reconstruction plate only, reconstruction plate with pectoralis major myocutaneous flap and reconstruction plate with microvascular free flap. The patients included in this study were operated in the time interval of October 2009 to April 2014 in Department of Oral and Maxillofacial Surgery at Sri Ramakrishna Hospital, Coimbatore.

The results of this study are shown under following subheadings:

1) Age and gender distribution
2) Side of tumour
3) Type of tumour
4) Type of resection
5) Type of mandibular defect
6) Type of reconstruction
7) Adjuvant radiotherapy
8) Facial appearance
9) Swallowing
10) Tolerance of diet
11) Speech
12) Activity

13) Overall quality of life

14) Postoperative complications

- Recipient site infection
- Donor site infection
- Wound dehiscence
- Flap necrosis
- Fistula
- Plate exposure
- Plate removal

AGE AND GENDER DISTRIBUTION:

In 18 cases with mandibular resection and reconstruction, the gender distribution showed 10 male patients and 8 female patients underwent reconstruction. The age distribution showed that 50% of the study population were in the 30 – 60 years age group and that micro vascular free flap were preferred by the <30 years group followed by 30 – 60 years age group. The mean age of the study group was 49.6 years. The overall quality of life scores were higher in patients of younger age (< 30 years) than in older age groups.

SIDE OF THE TUMOUR:

In the 18 cases, 44.4% of patients had resection and reconstruction performed on right side of mandible while 44.4% had involvement of left side. 11.1% had

resection and reconstruction due to lesions located in central portion of mandible. There was no significant association between side of resection and associated complications (P>0.05).

TYPE OF TUMOUR:

In the 18 cases included in the study, 5 patients underwent resection due to benign tumours and were reconstructed with reconstruction plate alone (n=2) or with micro vascular free flap (n=3). The patients with malignant tumour underwent resection and reconstruction with either reconstruction plate and pectoralis major myocutaneous flap (n=11) or reconstruction plate with microvascular free flap (n=2). There was significant association between speech domain and the type of tumour (P<0.05). The overall quality of life scores also had statistical significance with type of tumour (P<0.05).

TYPE OF RESECTION:

In the 18 cases of resection, 15 patients had segmental mandibulectomy done while 2 patients underwent hemimandibulectomy.1 patient had undergone marginal mandibulectomy.

TYPE OF MANDIBULAR DEFECT:

Out of 18 patients, 12 patients had lateral defects without involving condyle (L), 2 patients had lateral mandibular defects including condyle (H) while 4 patients had combination defects of mandible (LC or CL or LCL). There was no significant

association between type of mandibular defect and associated complications (P >0.05).

TYPE OF RECONSTRUCTION:

Of the 18 cases included in the study, 11 patients had reconstruction with reconstruction plate and pectoralis major myocutaneous flap, 5 patients had reconstruction with micro vascular free flap reconstruction with reconstruction plate and 2 patients received only reconstruction plate to maintain continuity of mandible. There was no statistically significant association between type of reconstruction and quality of life scores and associated complications (P >0.05).

ADJUVANT RADIOTHERAPY:

Of the 18 patients who underwent mandibular resection and reconstruction, 5 of the patients received adjuvant radiotherapy while 13 patients were confined only to surgical management. There was statistically significant association between radiotherapy and facial appearance, swallowing, speech and overall quality of life (P <0.05). The associated complications like recipient site infection and fistula formation were statistically significant in irradiated patients.

FACIAL APPEARANCE:

50% of reconstruction plate group (1/2), 9.1% of reconstruction plate with pectoralis major myocutaneous flap group (1/11), 40% of reconstruction plate with microvascular free flap group (2/5), 30.8% of non-irradiated patients (4/13), 60% of

benign tumour group (3/5) and 7.7% of malignant tumour group (1/13) reported their facial appearance as good.

54.6% of reconstruction plate with pectoralis major myocutaneous flap group (6/11), 20% of reconstruction plate with microvascular free flap group(1/5), 20% of irradiated patients (1/5), 53.9% of non-irradiated patients (7/13), 20% of benign tumour group (1/5) and 53.9% of malignant tumour group (7/13) were satisfied with their facial appearance.

50% of reconstruction plate group (1/2), 9.1% of reconstruction plate with pectoralis major myocutaneous flap group (1/11), 20% of reconstruction plate with microvascular free flap group (1/5), 60% of irradiated patients (3/5), 7.7% of non-irradiated patients (1/13), 20% of benign tumour group (1/5) and 23% of malignant tumour group (3/13) had acceptable appearance.

9.1% of reconstruction plate with pectoralis major myocutaneous flap group (1/11), 20% of reconstruction plate with microvascular free flap group (1/5), 20% of irradiated patients (1/5),7.7% of non-irradiated patients (1/13) and 15.4% of malignant tumour group (2/13) were dissatisfied with their facial appearance. There was statistically significant association between facial appearance and radiotherapy ($P < 0.05$) while type of tumour and the type of reconstruction did not have statistical significance ($P > 0.05$).

SWALLOWING:

The swallowing was found to be good in all patients (100%) in reconstruction plate only group (2/2), 63.6% of patients in reconstruction plate with pectoralis major myocutaneous flap group (7/11), 60% of patients in reconstruction plate with microvascular free flap group (3/5), 92.3% of non-irradiated patients (12/13), 100% of benign tumour group (5/5) and 53.9% of malignant tumour group (7/13).

Mild difficulty with swallowing was reported in 18.2% patients in reconstruction plate with pectoralis major myocutaneous flap group (2/11), 20% of patients in reconstruction plate with microvascular free flap group (1/5), 40% of irradiated patients (2/5) and 15.4% of malignant tumour group (2/13).

18.2% of patients in reconstruction plate with pectoralis major myocutaneous flap group (2/11), 20% of patients in reconstruction plate with microvascular free flap group (1/5), 60% of irradiated patients (3/5), 7.7% of non-irradiated patients (1/13) and 30.8% of malignant tumour group(4/13) reported moderate difficulty. There was statistically significant association between swallowing and radiotherapy ($P < 0.05$) while type of tumour and the type of reconstruction did not have statistical significance ($P > 0.05$).

TOLERANCE OF DIET:

All the patients (100%) in reconstruction plate only group, 63.6% patients in reconstruction plate with pectoralis major myocutaneous flap group (2/2), 80%

patients in reconstruction plate with microvascular free flap group (4/5), 84.6% of non-irradiated patients (11/13), 40% of irradiated patients (2/5), 100% of benign tumour group (5/5) and 61.5% of malignant tumour group (4/13) were able to tolerate a normal diet.

27.3% of patients in reconstruction plate with pectoralis major myocutaneous flap group (3/11), 20% of patients in reconstruction plate with microvascular free flap group (1/5), 15.4% of non-irradiated patients (2/13), 40% of irradiated patients (2/5) and 30.8% of malignant tumour group (4/13) were able to take only a semisolid diet.

9% of patients in reconstruction plate with pectoralis major myocutaneous flap group, 20% of irradiated patients (1/5) and 7.7% of malignant tumour group (1/13) were dependent on gastric tube for feeding. There was no statistical correlation between tolerance of diet and type of tumour and type of reconstruction while radiotherapy had statistical significance ($P < 0.05$).

SPEECH:

100% of patients in reconstruction plate only group (2/2), 18.2% of patients in reconstruction plate with pectoralis major myocutaneous flap (2/11), 40% of patients in reconstruction plate with microvascular free flap group (2/5), 46.4% of non-irradiated patients, 80% of benign tumour group (4/5) and 15.4% of malignant tumour group (2/13) had normal speech.

The speech was easily understandable in 36.4% of patients in reconstruction plate with pectoralis major myocutaneous flap group (4/11), 20% of patients in reconstruction plate with microvascular free flap group (1/5), 20% of irradiated patients (1/5), 30.8% of non-irradiated patients (4/13), 20% of benign tumour group (1/5) and 38.5% of malignant tumour group (5/13).

45.5% of patients in reconstruction plate with pectoralis major myocutaneous flap group (5/11), 40% of patients in reconstruction plate with microvascular free flap group (2/5), 80% of irradiated patients (4/5), 23% of non-irradiated patients (3/13) and 53.9% of malignant tumour group (7/13) found that their speech was difficult to understand by others.

The speech domain had statistical significance with radiotherapy and type of tumour ($P < 0.05$) while type o reconstruction demonstrated no such significance.

ACTIVITY:

100% of patients in reconstruction plate only group (2/2), 81.8% of patients in reconstruction plate with pectoralis major myocutaneous flap (9/11), 80% of patients in reconstruction plate with microvascular free flap group (4/5), 92.3% of non-irradiated group (12/13), 60% of irradiated group (3/5), 100% of benign tumour group (5/5) and 76.9% of malignant group (10/13) were able to carry out their normal activity.

18.2% of patients in reconstruction plate with pectoralis major myocutaneous flap group (2/11), 20% of patients in reconstruction plate with microvascular free flap group (1/5), 7.7% of non-irradiated group (1/13), 40% of irradiated group (2/5) and 23% of malignant group (3/13) were moderately active. There was no statistical significant correlation between type of reconstruction, type of tumour or radiotherapy (P >0.05).

OVERALL QUALITY OF LIFE:

The overall quality of life was found to be good in 100% of patients in reconstruction plate only group (2/2), 27.3% of patients in reconstruction plate with pectoralis major myocutaneous flap (3/11), 60% of patients in reconstruction plate with microvascular free flap group (3/5), 61.5% of non-irradiated group (8/13), 100% of benign tumour group (5/5).

It was fair in 45.5% of patients in reconstruction plate with pectoralis major myocutaneous flap (5/11), 20% of patients in reconstruction plate with microvascular free flap group (1/5), 30.8% of non-irradiated group (4/13), 40% of irradiated group (2/5) and 46.2% of malignant tumour group (6/13).

The overall quality of life was found to be acceptable in 18.2% of patients in reconstruction plate with pectoralis major myocutaneous flap (2/11), 20% of patients in reconstruction plate with microvascular free flap group (1/5), 7.7% of non-irradiated group, 40% of irradiated group (2/5) and 23% of malignant tumour group (3/13). 9% of patients in reconstruction plate with pectoralis major myocutaneous

flap (1/11), 20% of irradiated group (1/5) and 7.7% of malignant tumour group (1/13) had poor overall quality of life.

There was statistical significance between overall quality of life with radiotherapy and type of tumour while type of reconstruction had no such statistical significance (P>0.05).

POSTOPERATIVE COMPLICATIONS:

RECIPIENT SITE INFECTION:

In our study recipient site infection was seen in 38.9% of cases of reconstruction.23% of non-irradiated patients (3/13), 80% of irradiated patients(4/5), 45.5% of reconstruction plate with pectoralis major myocutaneous flap group (5/11), 40% of reconstruction plate with microvascular free flap group (2/5), 53.9% of malignant tumour patients(7/13), 50% of right sided lesions (4/8), 25% of left sided lesions (2/8), 50% of central lesions(1/2), 50% of lateral defects (6/12), 25% of combination defects (1/4) had infection of the recipient site. There was significant relation with radiotherapy (P <0.05) while type of reconstruction, type of tumour, side of resection and type of defect had no statistical significance.

DONOR SITE INFECTION:

In our study 5.6% of cases with flap reconstruction had infection of donor site.7.7% of non-irradiated patients (1/13), 9.1% of reconstruction plate with pectoralis major myocutaneous flap group (1/11), 7.7% of malignant tumour patients(1/13), 12.5% of right sided lesions (1/8), 8.3% of lateral defects (1/12) had donor site infection. There was no significant association with radiotherapy, type of reconstruction, type of tumour, side of resection and type of defect.

WOUND DEHISCENCE:

Out of 18 cases included in our study 38.9% of the patients had wound dehiscence.30.8% of non-irradiated patients (4/13), 60% of irradiated patients (3/5), 45.5% of reconstruction plate with pectoralis major myocutaneous flap group (5/11), 40% of reconstruction plate with microvascular free flap group (2/5), 53.9% of malignant tumour patients(7/13), 37.5% of right sided lesions (3/8), 37.8% of left sided lesions (3/8), 50% of central lesions(1/2), 50% of lateral defects (6/12), 25% of combination defects (1/4) had wound dehiscence. There was no significant association with radiotherapy, type of reconstruction, type of tumour, side of resection and type of defect.

FLAP NECROSIS:

In our study flap necrosis was observed in 22.2% of cases.15.4% of non-irradiated patients (2/13), 40% of irradiated patients (2/5), 27.3% of reconstruction

plate with pectoralis major myocutaneous flap group (3/11), 20% of reconstruction plate with microvascular free flap group (1/5), 30.8% of malignant tumour patients(4/13), 25% of right sided lesions (2/8), 12.5% of left sided lesions (1/8), 50% of central lesions(1/2), 25% of lateral defects (3/12), 25% of combination defects (1/4) had necrosis of flap. There was no significant association with radiotherapy, type of reconstruction, type of tumour, side of resection and type of defect.

FISTULA FORMATION:

Orocutaneous fistula formation was seen in 22.2% of patients.7.7% of non-irradiated patients (1/13), 60% of irradiated patients (3/5), 27.3% of reconstruction plate with pectoralis major myocutaneous flap group (3/11), 20% of reconstruction plate with microvascular free flap group (1/5), 30.8% of malignant tumour patients(4/13),25 % of right sided lesions (2/8), 12.5% of left sided lesions (1/8), 50% of central lesions(1/2), 25% of lateral defects (3/12), 25% of combination defects (1/4) had fistula formation. There was significant relation with radiotherapy ($P < 0.05$) while type of reconstruction, type of tumour, side of resection and type of defect had no statistical significance.

PLATE EXPOSURE:

Exposure of the reconstruction plate was seen in 27.8% of cases.15.4% of non-irradiated patients (2/13),60% of irradiated patients (3/5), 27.3% of reconstruction plate with pectoralis major myocutaneous flap group (3/11), 40% of reconstruction

plate with microvascular free flap group (2/5), 38.5% of malignant tumour patients(5/13), 37.5% of right sided lesions (3/8), 12.5% of left sided lesions (1/8), 50% of central lesions(1/2), 33.3% of lateral defects (4/12), 25% of combination defects (1/4) had plate exposure. There was no significant association with radiotherapy, type of reconstruction, type of tumour, side of resection and type of defect.

PLATE REMOVAL:

In our study plate removal was necessary in 27.8% of patients. 15.4% of non-irradiated patients (2/13),60% of irradiated patients (3/5), 27.3% of reconstruction plate with pectoralis major myocutaneous flap group (3/11), 40% of reconstruction plate with microvascular free flap group (2/5), 38.5% of malignant tumour patients(5/13), 37.5% of right sided lesions (3/8), 12.5% of left sided lesions (1/8), 50% of central lesions(1/2), 33.3% of lateral defects (4/12), 25% of combination defects (1/4) underwent plate removal. There was no significant association with radiotherapy, type of reconstruction, type of tumour, side of resection and type of defect.

OCCLUSION:

In our study of 18 cases 61.1% of patients had a normal occlusion of the contralateral side while 16.7% of patients had deranged occlusion. The status of occlusion could not be applied to 22.2% of population due to their completely edentulous or partially edentulous state.23% of non-irradiated patients (3/13), 18.2%

of reconstruction plate with pectoralis major myocutaneous flap group (2/11), 20% of reconstruction plate with microvascular free flap group (1/5), 23% of malignant tumour patients(3/13), 25% of right sided lesions (2/8), 12.5% of left sided lesions (1/8), 50% of central lesions(1/2), 25% of lateral defects (3/12), 25% of combination defects (1/4) had deranged occlusion. There was no significant association with radiotherapy, type of reconstruction, type of tumour, side of resection and type of defect.

PAIN/TENDERNESS IN TMJ:

Among our 18 patients of study, pain in contralateral TMJ was seen in 5.6% of patients.7.7% of non-irradiated patients(1/13), 9.1% of reconstruction plate with pectoralis major myocutaneous flap group (1/11), 7.7% of malignant tumour patients(1/13), 12.5% of right sided lesions (1/8), 8.3% of lateral defects (1/12) had pain in TMJ. There was no significant association with radiotherapy, type of reconstruction, type of tumour, side of resection and type of defect.

DEVIATION IN MOUTH OPENING:

Deviation of jaw towards resected side was seen in 16.7% of patients in our study. 15.4% of non-irradiated patients (2/13), 20% of irradiated patients (1/5), 18.2% of reconstruction plate with pectoralis major myocutaneous flap group (2/11), 20% of reconstruction plate with microvascular free flap group (1/5), 23% of malignant tumour patients(3/13), 25% of right sided lesions (2/8), 12.5% of left sided lesions (1/8), 50% of central lesions(1/2), 25% of lateral defects (3/12) had deviation

of jaw during mouth opening. There was no significant association with radiotherapy, type of reconstruction, type of tumour, side of resection and type of defect.

Discussion

Reconstructive maxillofacial surgery refers to the wide range of procedures designed to rebuild or enhance soft or hard tissue structures of the maxillofacial region. This remains a challenge to the surgeon and is employed in cases of malignant tumours, benign tumours, trauma, osteoradionecrosis, infection, clefts, congenital deformities and old age.[39]

Though the TNM classification of oral cancer is based on size and extent of involvement of hard and soft tissues and provides a means for stratification, communication and prognostication it is not suitable for describing the reconstructive needs.[8] This led to proposal of classification of mandibular defects by Jewer et al[23] according to the site of defect such as central (C), lateral with condyle (H) or lateral without condyle (L) and combination defects (LC or CL or LCL). This was later modified by Boyd et al[8] to overcome difficulties in classifying the mandibular defects when there was a skin or mucosal defect. The letters 'o' indicate neither a skin nor mucosal component,'s' for skin, 'm' for mucosa and 'sm' for skin and mucosa.

The anterior segmental defects well known as the 'Andy Gump Deformity' can affect the patient's ability to maintain oral intake or may lead to airway obstruction while lateral defects in dentate mandible or segmental defects in edentulous mandible may be tolerated better.[33] Nevertheless the loss of continuity of mandible can be disfiguring and disabling. In addition to the devastating effect on the mechanics of mastication, oral incompetence and dysarthria may result due to the

loss of support and contraction of perioral soft tissues, tethering of lip and tongue. This is usually further worsened by adjuvant radiotherapy. Most importantly, the change in facial appearance has a terrible impact on the patient's feeling of self confidence and their desire to return to their pre-disease state of life.[33]

Disfigurement and impaired oral function of patients who underwent mandibular reconstruction adversely affect the health related quality of life. Quality of life may be described as the "gap between one's actual functional level and one's ideal standard," but it is important to keep in mind that a patient's assessment of their quality of life is dynamic, changing over time and situations. Patient assessment of quality of life tends to be the worst in the months after surgery, improving slightly at 1 year, or even approaching pretreatment levels with time.[13]

Even though evaluation and comparison of different mandibular reconstructions have already been reported in literature, most of them focus only on physical outcomes rather than psychological outcome. For surgeons it is important to understand the patient's perception of their health related quality of life and their influencing factors.[24,42] This may serve as an important factor for optimizing the choice of reconstruction. The relatively large number of questionnaires specific for diseases of the oral cavity reflects that there is no 'gold standard'.[24] In our study, we modified the University of Washington- Quality Of Life questionnaire so that it can be easily applied to our Indian population. The concerns of a patient with benign lesions are clearly different from those of cancer patients. Despite undergoing surgical resection, the patient's life expectancy is not adversely at risk[17] and they tend

to expect a more satisfying outcome after surgery than patients treated for malignancies.

In our study 10 males and 8 females underwent mandibular reconstruction. The mean age for our study population was 49.61 years. In our study the age distribution showed that 50% of the study population were in the 30 – 60 years age group and that micro vascular free flap were preferred by the <30 years group followed by 30 – 60 years age group. Eyituoyo et al[17] stated a significant relation between age of patient and quality of life while Qilong Wan et al[42] found no such significance. The mean overall quality of life score in our study was 14.6 (fair) with higher scores in younger patients (< 30 years) than in older age group. This may be the result of better adaptability of younger age group to changes following resection and reconstruction than the older age group.

In the 18 cases included in our study 15 patients underwent segmental mandibulectomy while 2 patients had hemi mandibulectomy done. Marginal mandibulectomy was performed in 1 patient. In our study 44.4% of patients had resection and reconstruction performed on right side of mandible while 44.4% had involvement of left side. 11.1% had resection and reconstruction due to lesions located in central part of mandible.

Of the 18 cases included in the study, 11 patients had reconstruction with reconstruction plate and pectoralis major myocutaneous flap, 5 patients had reconstruction with micro vascular free flap reconstruction with reconstruction plate

and 2 patients received only reconstruction plate to maintain continuity of mandible. In our study the leading cause for resection was squamous cell carcinoma followed by ameloblastoma.

Facial appearance is reported as the most concerning domain in the quality of life questionnaire from patients' perspective in various studies especially in younger patients.[24] In our study in reconstruction with pectoralis major myocutaneous flap, 9.1% patients reported their facial appearance as good while 54.6% were satisfied with their facial appearance. 9.1% of reconstruction plate with pectoralis major myocutaneous flap group had acceptable appearance and 9.1% were dissatisfied with their facial appearance. Raphael Lopez et al[45], Chih- Yu Hsing et al[10], P.Salvatori et al[38] and Mohamed A.F.El-Zohairy et al[34] found that most of the patients reconstructed with pectoralis major myocutaneous flap found their appearance as satisfied or good.

In reconstruction with microvascular free flap group, 40% reported their facial appearance as good while 20% found the appearance to be fair, 20% found it acceptable and 20% were dissatisfied. The dissatisfaction was due to the total flap loss due to hematoma and infection. The findings of Lidiya Zavalishna et al[30], Raul Gonzalez – Garcia et al[46], Bartaire et al[6], Hidalgo et al[12] reported a high incidence of 97% of patient satisfaction with free flap reconstruction.

In our study we found that in reconstruction plate group 50% of patients found their appearance as good and the other 50% found their appearance to be acceptable.

S.Arun Paul[48] and K.R.Spencer et al[25] reported higher incidence of patient satisfaction upto 94%. The results of our study revealed no statistically significant difference in facial appearance domain among different types of reconstruction. T.J.Verhoeven et al[50] introduced a new method to quantify soft tissue facial asymmetry in patients who underwent mandibular reconstruction using 3D photographs obtained using stereophotogrammatrical camera. This may serve a useful tool for expert assessment for facial asymmetry and may reveal correlation between facial appearance among various types of reconstruction as expert assessment and patient assessment had significant difference in the study reported by Lidiya Zavalishna et al[30].

In our study, 63.6% of patients in reconstruction plate with pectoralis major myocutaneous flap group were able to swallow solids and liquids normally while mild difficulty was noticed in 18.2% of patients and 18.2% patients found swallowing food moderately difficult. In the study by Lidiya Zavalishna et al[30] 63.6% of free flap patients had normal swallowing while 9% patients had mild difficulty and 18.2% patients had moderate difficulty. In our study 60% of patients in microvascular free flap group reported that they did not have any problem with swallowing while 20% patients had mild and 20% patients had moderate difficulty. Juanfang Zhu et al[24] reported that swallowing was not a problem of concern to free flap patients.

Literature states that in patients with pectoralis major myocutaneous flap reconstruction, 40-90% of them were able to take a normal diet.[45,34] In our study

63.6% of patients were able to take a normal diet while 27.3% patients were restricted to semisolid diet. 9% of patients were dependent on gastric tube for feeding due to oral incompetence owing to presence of orocutaneous fistula in floor of mouth following flap necrosis. The patient had to returned for the orocutaneous closure after a period of 2 years. The patient later underwent repair of orocutaneous fistula which healed uneventfully. Raphael Lopez et al[45] reported 13% of their study population to be tube dependent for diet. In our study, 80% of free flap patients were able to tolerate a normal diet while 20% were on a semisolid diet. Juanfang Zhu et al[24] and David Hidalgo et al[12] stated that 70% of their study population with free flap reconstruction were able to have a normal diet while 30% were restricted to semisolid diet. In our study though most of the free flap patients were able to tolerate normal diet and had no or mild difficulty in swallowing compared to other reconstruction techniques, the values were not statistically significant. ($P>0.05$) Qilong Wan et al[42] stated that there was significant difference among free flap and other reconstruction techniques only in appearance, speech and chewing.

According to literature, 85% of free flap patients report to have normal speech[12]. In our study 40% of patients had normal speech while 20% of patients reported that others found mild difficulty in understanding their words. 40% patients reported that others could understand their words with moderate difficulty. The tethering of tongue was cited as reason by the patients for the same. Mohamed A.F.El-Zohairy et al[34] reported that 90% of patients with pectoralis major myocutaneous flap had normal speech. In our study majority of patients in this group

(45.5%) stated that their speech was understood with moderate difficulty. Only 18.2% patients were able to maintain normal speech. This can be due to the fact that resection in this group was extensive involving tongue and other soft tissues as result of treatment of malignancy. Chih- Yu Hsing et al[10] and Qilong Wan et al[42] reported significant difference between free flap and other reconstruction methods only in the speech domain of quality of life analysis. In our study there was no statistically significant difference in speech domain between the different types of reconstruction though the number of free flap patients with normal speech were higher than the other counterparts.

In our study, 81.8% of pectoralis major myocutaneous flap group and 80% of free flap group were able to carry out their normal activities while 20% of them restricted their activity to a moderate level mainly as a result of their dissatisfied facial appearance and fatigue due to lack of balanced diet. Lidiya Zavalishna et al[30] stated that only 45% of their free flap study group reported normal activity while literature states higher normal activity rates.

In our study we found that in patients reconstructed only with bridging plates had no problems problems associated with swallowing, tolerance of diet, speech or activity. The overall quality of life scores were also found to be good. This can be attributed to the fact that this type of reconstruction was carried out only in cases of benign tumours which required a lesser extensive resection compared to malignancy and absence of irradiation. The only problem with facial appearance in a patient in this group was absence of chin prominence due to anterolateral defect of mandible.

In our study we found that mean overall quality of life scores was 14.6 (fair). Overall quality of life scores were in higher side of scale for reconstruction plate only group followed by free flap group while majority of pectoralis major myocutaneous flap group patients had fair scores. The differences in quality of life scores were not statistically significant among the different methods of reconstruction. Qilong Wan et al[42] also found that their study population had good overall quality of life scores among all groups with significant difference in free flap group in the appearance, speech and swallowing domains. Lidiya Zavalishna et al[30] found that the free flap patients were satisfied with their overall quality of life. Chih-Yu Hsing et al[10] reported that there was no statistical difference between free flap and pectoralis major myocutaneous flap group in all domains of quality of life except for speech.

In our study statistical significance was found between irradiated and non-irradiated patients in terms of facial appearance, swallowing, speech and overall quality of life score.($P>0.05$). Analysis of quality of life scores for benign and malignant tumours showing that esthetic outcome was less satisfying in patients with malignancy and irradiation was reported by Lidiya Zavalishna et al.[30]

David Vu et al[13] and Lidiya Zavalishna et al[30] reported statistically significant difference in different domains and overall quality of life among irradiated and non-irradiated patients. Irradiation is known to have significant effects on various tissues of the oral cavity. One of the main disadvantages is a marked decrease in salivation leading to difficulty in swallowing, tolerating a normal diet and speech due to loss of

lubricating effect of saliva. There are also changes in soft tissues of oral cavity as a result of fibrosis.

In our study there was significant difference between benign tumours and malignant tumours in terms of individual domains of quality of life especially in speech and overall score. Eyituoyo et al[17] and Lidiya Zavalishna et al[30] found that patients treated for benign tumours rather than malignancies had better scores for quality of life domains especially speech and swallowing. This is because phonation capacities mainly depend on involved soft tissue resection. The amount of soft tissues resected is greater while treating a malignancy than in benign tumour as the extent of resection is a result of primary tumour infiltration or for the sake of three dimensional clearance.

David Vu et al[13] states that the quality of life scores tend to change over time as initially the patients find the changes following resection and reconstruction difficult to adapt but may later tend to get along with the modification of lifestyle. Lidiya Zavalishna et al[30] found that the quality of life scores given by the patient itself and given by a expert after assessing the patient tend to vary significantly. The patient assessment resulted in higher values compared to expert assessment. This reveals that patients tend to accept the lifestyle modifications over period of time while experts look out for more realistic reconstruction.

The quality of life analysis stated in literature has been conducted among different populations in different parts of the world and has given variable results.

This disparity in scoring may be due to the involved cultural, ethnic, and environmental factors of the study population. These factors must also be considered while optimizing the treatment plan for a patient which should be individualized according to patient needs.

The influence of postoperative complications is very crucial in terms of the final outcome of the reconstruction and the quality of life of patient. In our study we evaluated the postoperative complications encountered by patients among various types of reconstruction.

The range of recipient site infection stated by literature is 2.8 – 14%.[6,14,46,35.] The overall recipient site infection rate found in our study was 38.9% with 80% of them occurring in irradiated patients. The overall donor site infection rate in our study was 5.6%. The infection rate of the donor site reported in literature is 5 – 13%.[6,35] The end of study showed no significant association between side of resection, type of defect, type of reconstruction and recipient and donor site infection($P > 0.05$) while recipient site infection was significantly related to radiotherapy ($P<0.05$). Factors such as duration of surgery, interval between graft harvest and placement, time surgical drain being left in situ have contributed to the incidence of graft infection.[52]

The incidence of wound dehiscence in our study was 38.9% with higher incidence in irradiated patients. Mohamed A.F.El-Zohairy et al[34] reported that incidence of wound dehiscence to be 9.1% while Raul Gonzalez – Garcia et al[46] reported it to be 3.6%. The end of study showed no significant association between

side of resection, type of defect, type of reconstruction, radiotherapy and wound dehiscence($P > 0.05$) while it was significantly related to type of tumour.

The flap loss rate in literature is reported to be 3 to 32% .[6,14, 34,32]In our study overall flap necrosis was found to be 22.2%. The flap necrosis was found to have no significant association with type of defect, side of resection and type of reconstruction. But the incidence was higher in irradiated patients than non-irradiated patients though not statistically significant. There was significant difference in flap necrosis in patients treated for benign and malignant tumours. There were 2 cases of complete flap loss due to necrosis in our study. One was in a patient reconstructed with reconstruction plate with pectoralis major myocutaneous flap group and was a case of carcinoma of floor of mouth with anterolateral defect of mandible and history of irradiation. Anterolateral defects of mandible result in loss of attachment of muscles of floor of mouth and tongue.[19]This results in altered muscle forces that result in loss of soft tissue flap exposing the underlying bridging plate. Another case was seen in microvascular free flap reconstruction with no history of irradiation. The necrosis was secondary to hematoma formation under the soft tissue component of the flap. Though hematoma evacuation was carried out the flap proceeded to necrose and resulted in loss of soft tissue and part of osseous part of the flap. Though secondary reconstruction was suggested for the defect, the patient chose not to undergo the procedure. Earlier studies have found that infection, vascular compression, venous thrombosis and visible graft may lead to removal of fibula flap.[35]

In literature the fistula formation following flap reconstruction is reported to be from 5%[12] to as high as 69%.[34,35] The incidence of fistula formation in our study was 22%. The higher incidence of fistula formation with statistical significance (P<0.05) in irradiated patients can be attributed to the fibrosis that follows early radiotherapy.

The complications occurring at the recipient site have most often been associated with vessel thrombosis and infection and complications at the donor site have most often been related to infection, the process of flap harvesting itself, or, even more rarely to distal limb ischemia.[30]

In our study the overall plate exposure and removal rate was found to be 27.8%. In literature the plate exposure and removal rate ranges from 6-37% [11,25,32,40,45,48] We found that the plate exposure and plate removal was 37% (3/8) in right side defects, 12.5% (1/8) in left side defects and 50% in resection of central lesions of mandible but was not of statistical significance (P > 0.05). In our study the plate exposure and removal rate in patients who underwent radiotherapy was 60% and 15.4% in non-irradiated patients. Peter Maurer et al[40] reported plate exposure to be 66.7% in irradiated patients. Masaya Okura et al[32] and K.R.Spencer et al[25] also reported poor prognosis of plate survival in irradiated patients. A new flap or local procedure can be used to solve plate exposure problems. Si-Lian Fang et al[49] showed that extended lower vertical trapezius flap island myocutaneous flap can be used to cover exposed intraorally, extraorally or both.

We found that 33.3% of patients with lateral defects of mandible, 25% of patients with combination defects (LC or CL or LCL) in our study had plate exposure followed by removal. Masaya Okura et al[32], K.R.Spencer et al[25] and Raphael Lopez et al[45] found that the anterolateral defects had worse prognosis than the lateral defects. Gilles Guerrier et al[19] and Peter Maurer et al[40] reported no correlation between anatomical site and plate complications. Segmental resection of the anterior mandible causes the muscles of the floor of the mouth and tongue to lose their insertion to the mandible resulting in retraction of chin and lower lip over time.[45]

The possible factor involved in plate exposure could be both contracture and a tenuous vascular supply of the skin overlying the plate. Scar contracture produces a retraction toward the side of the dead space created underlying the plate, leading to poor vascularization of the skin overlying the plate and eventually to the dehiscence. Preoperative irradiation may increase the possibility of the plate exposure due to poor vascularisation of the irradiated tissues.[32] Florian Andreas Probst et al[18] suggested that the use of Matrix Mandible reconstruction plates with bendable proximal and distal parts and non-bendable center can minimize risk of fatigue fractures and complications for anterolateral defects.

The correlation between plate exposure and removal with type of defect, type of reconstruction and irradiation was not statistically significant ($P > 0.05$) while it was of significance in reconstructions following malignant tumour. Literature states that a

rest period of 6-8 weeks after preoperative radiotherapy may result in lesser complications.

In our study none of the patients treated for benign tumours had plate exposure or removal while 38.5% of patients treated for malignant tumours had exposure and removal of plate. This can be attributed to the factor that resection of benign tumour involves lesser soft tissue loss compared to the treatment of malignancies. This provides good bulk of tissue available for plate coverage. Absence of irradiation may also be a contributory factor.

In our study 61.1% of patients had normal occlusion following reconstruction. The occlusion was deranged in 16.7% while 22.2% were either edentulous or partially edentulous. In our study we found that pain in TMJ was present in 5.6% patients. The deviation during mouth opening was present in 16.7% of patients in our study. But these findings did not have any statistical significance in relation to type of defect, type of reconstruction, radiotherapy, type of tumour or side of resection. Loss of mandibular continuity results in deviation of the mandible toward the resected side due to the unopposed pull of the remaining muscles of mastication and soft tissue contracture and scar formation. There is limited range of motion when attempting lateral and protrusive movements of the jaw with a return to midline on opening or closing secondary to the remaining contralateral muscles of mastication. In addition, malocclusion and problems with proprioception occur.[39] A.M.Fry et al[2] developed a new technique for creating intermaxillary splint and positioning stents to guide mandibular reconstruction using thermoforming plastic vacuum-formed over

cast made from impression made after prebent reconstruction plate was adapted to 3D model by wax. The splint helps to hold the remaining mandibular segments in correct occlusal relationship with maxilla while the stent is used as guide to place the plate in desired position.

The success rate for use of reconstruction plate was reported as 71% by Spencer et al[25] and Masaya Okura et al[32] while S.Arun Paul et al[48] reported a success rate of 94%. In our study the success rate for reconstruction plate alone group was 100% as it was used following resection of benign tumours.

In our study reconstruction with reconstruction plate with pectoralis major myocutaneous flap group was 72.7%. Salvatori et al[38] reported a success rate of 85% with reconstruction plate and pectoralis major myocutaneous flap while Mohammed A.F.El-Zohairy[34] et al reported that they had higher success rate of 100% with only minor complications. The other studies reported success rates ranging from 61 – 86%[45]

The success rate for free flap has ranged from 82-97%.[30] The success rate for free flap reconstruction in our study was 80%. Parbo et al[35], David D.Vu et al[13] had reported higher success rates of 97% and 100% respectively.

Summary & Conclusion

This study of evaluating the different mandibular reconstruction techniques following resection of benign and malignant tumours was conducted in Department of Oral and Maxillofacial Surgery, Sri Ramakrishna Dental College and Hospital, Coimbatore. This study analysed 18 patients who underwent different mandibular reconstruction techniques such as microvascular free flap with reconstruction plate, pectoralis major myocutaneous flap with reconstruction plate and reconstruction plate only and evaluated the quality of life and postoperative complications.

Though the patients with microvascular free flap reconstruction had better scores for various domains determining their quality of life, the other reconstruction methods were not far behind. Among the various domains of the quality of life analysis, facial appearance was the most concerning domain of the patients especially in younger age group followed by swallowing and tolerance of diet. The younger age group (<30 years) had better quality of life scores than the older age groups.

Our study revealed that the patients' level of satisfaction with the various types of reconstruction in terms of the essential domains of day to day life like facial appearance, swallowing, tolerance of diet, speech, activity and overall quality of life were fair to good irrespective of method of reconstruction.

The irradiated patients had a lower quality of life scores compared to non-irradiated patients with statistically significant results in domains of facial appearance, swallowing, speech and overall quality of life. The patients who underwent reconstruction following resection due to benign tumours had better scores for various domains of quality of life though statistical analysis was not possible.

The postoperative complications was present in all types of reconstruction but had higher incidence in irradiated patients and patients treated for malignancy. The recipient site infection and fistula formation were statistically higher in patients with irradiation history. The incidence of postoperative complications were noted in cases of malignancy rather than in benign tumour patients. The plate exposure and removal was found in both free flap and pedicled flap reconstruction techniques with increased frequency in irradiated patients.

Though the microvascular free flap reconstruction has become the choice of surgeons in order to achieve superior esthetic and functional outcome, in a developing country like India the microvascular free flap remains a valuable asset available to only certain people owing to the facts such as higher cost, need for specialized equipments, microvascular surgeons and fitness to undergo the longer operating time. The pectoralis major myocutaneous flap on the other hand though not preferred as the first line of choice for mandibular reconstruction at present, have shown to serve the purpose successfully when used. The lesser cost, simplicity of harvesting and proximity to head and neck region makes it the preferred pedicled

flap when needed. The flap also provides bulk for reconstruction in cases of extensive resection following locally advanced diseases but the same bulk may act as disadvantage in certain cases. The other disadvantages of the flap such as increased incidence of infection, partial or complete flap necrosis, dehiscence or fistula formation especially following irradiation can be managed conservatively although more aggressive procedures may be needed occasionally. The reconstruction plate alone used to bridge segmental mandibular defects are used only when other popular reconstruction method are not feasible.

Though our study had a smaller sample size, the results suggest that the proper planning and execution of the reconstruction technique combined with important cofactors like type of tumour and irradiation serve as key factors in determining the quality of life of patients rather than the method of reconstruction proper. Prospective study with larger sample size and longer follow-up with periodic analysis may be necessary to reemphasize the results of our study.

Tables

TABLE 1	PATIENTS SUMMARY								
SL.NO	**PATIENT NAME**	**AGE/GENDER**	**DIAGNOSIS**	**SIDE OF LESION**	**SITE OF LESION**	**TYPE OF MANDIBULAR RESECTION**	**TYPE OF MANDIBULAR DEFECT**	**TYPE OF RECONSTRUCTION**	**RADIOTHERAPY**
1	MR.MAYILSAMY	62/M	CARCINOMA	CENTER	ANTERIOR MANDIBLE	SEGMENTAL	LCL	RECONSTRUCTION PLATE + PMMC FLAP	YES
2	MR.GOWTHAM	20/M	AMELOBLASTOMA	RIGHT	POSTERIOR MANDIBLE	HEMI	H	FREE FIBULA FLAP + RECONSTRUCTION PLATE	NO
3	MR.SARAVANAN	39/M	CARCINOMA	RIGHT	POSTERIOR MANDIBLE	SEGMENTAL	L	RECONSTRUCTION PLATE + PMMC FLAP	NO
4	MRS.MALATHY	28/F	KERATOCYSTIC ODONTOGENIC TUMOUR	LEFT	POSTERIOR MANDIBLE	HEMI	H	FREE FIBULA FLAP + RECONSTRUCTION PLATE	NO
5	MR.PADMANABAN	66/M	CARCINOMA	LEFT	BUCCAL MUCOSA	SEGMENTAL	L	RECONSTRUCTION PLATE + PMMC FLAP	NO
6	MRS.PALANIAMMAL	55/F	CARCINOMA	RIGHT	LOWER ALVEOLUS	SEGMENTAL	L	RECONSTRUCTION PLATE + PMMC FLAP	NO
7	MR.NATRAJ	57/M	CARCINOMA	LEFT	LOWER ALVEOLUS	SEGMENTAL	L	RECONSTRUCTION PLATE + PMMC FLAP	YES
8	MRS.SIVAGAMI	52/F	CARCINOMA	LEFT	LOWER ALVEOLUS	SEGMENTAL	L	RECONSTRUCTION PLATE + PMMC FLAP	YES
9	MRS.RENU JALAN	58/F	CARCINOMA	RIGHT	LOWER GINGIVOBUCCAL SULCUS	SEGMENTAL	L	FREE FIBULA FLAP + RECONSTRUCTION PLATE	NO
10	MRS.SATHYA	25/F	OSSIFYING FIBROMA	RIGHT	POSTERIOR MANDIBLE	SEGMENTAL	CL	FREE FIBULA FLAP + RECONSTRUCTION PLATE	NO
11	MRS.VENKATAMMAL	69/F	CARCINOMA	RIGHT	BUCCAL MUCOSA	SEGMENTAL	L	RECONSTRUCTION PLATE + PMMC FLAP	YES
12	MR.DEVNATH	27/M	AMELOBLASTOMA	LEFT	POSTERIOR MANDIBLE	MARGINAL	L	RECONSTRUCTION PLATE	NO
13	MR.BASKAR	38/M	CARCINOMA	RIGHT	BUCCAL MUCOSA	SEGMENTAL	L	RECONSTRUCTION PLATE + PMMC FLAP	NO
14	MRS.RAJAMANI	70/F	CARCINOMA	LEFT	BUCCAL MUCOSA	SEGMENTAL	L	RECONSTRUCTION PLATE + PMMC FLAP	NO
15	MR.NAGARAJAN	52/M	AMELOBLASTOMA	CENTER	ANTERIOR MANDIBLE	SEGMENTAL	CL	RECONSTRUCTION PLATE	NO
16	MR.MAHENDRAN	38/M	CARCINOMA	RIGHT	BUCCAL MUCOSA	SEGMENTAL	L	FREE ANTEROLATERAL THIGH FLAP + RECONSTRUCTION PLATE	YES
17	MR.SRINIVASAN	77/M	CARCINOMA	LEFT	BUCCAL MUCOSA	SEGMENTAL	L	RECONSTRUCTION PLATE + PMMC FLAP	NO
18	MRS.KALIAMMAL	60/F	CARCINOMA	LEFT	BUCCAL MUCOSA	SEGMENTAL	CL	RECONSTRUCTION PLATE + PMMC FLAP	NO

TABLE 2: AGE DISTRIBUTION

AGE	FREQUENCY			PERCENTAGE		
	RP	**RP+ PMMC FLAP**	**RP + MICROVASCULAR FREE FLAP**	**RP**	**RP+ PMMC FLAP**	**RP + MICROVASCULAR FREE FLAP**
< 30 YEARS	1	0	3	5.6	0	16.7
30-60 YEARS	1	6	2	5.6	33.3	11.1
> 60 YEARS	0	5	0	0	27.8	0
TOTAL	2	11	5	11.2	61.1	27.8

TABLE 3: GENDER DISTRIBUTION

GENDER	FREQUENCY			PERCENTAGE		
	RP	**RP+ PMMC FLAP**	**RP + MICROVASCULAR FREE FLAP**	**RP**	**RP+ PMMC FLAP**	**RP + MICROVASCULAR FREE FLAP**
MALE (n=10)	2	6	2	11.2	33.3	11.1
FEMALE (n=8)	0	5	3	0	27.8	16.7
TOTAL	2	11	5	11.2	61.1	27.8

TABLE 4: SIDE OF TUMOUR DISTRIBUTION

SIDE OF TUMOUR	FREQUENCY			PERCENTAGE		
	RP	RP+ PMMC FLAP	RP + MICROVASCULAR FREE FLAP	RP	RP+ PMMC FLAP	RP + MICROVASCULAR FREE FLAP
RIGHT	0	4	4	0	22.2	22.2
LEFT	1	6	1	5.6	33.3	5.6
CENTRAL	1	1	0	5.6	5.6	0
TOTAL	2	11	5	11.2	61.1	27.8

TABLE 5: TYPE OF TUMOUR DISTRIBUTION

TYPE OF TUMOUR	FREQUENCY			PERCENTAGE		
	RP	RP+ PMMC FLAP	RP + MICROVASCULAR FREE FLAP	RP	RP+ PMMC FLAP	RP + MICROVASCULAR FREE FLAP
BENIGN	2	0	3	11.2	0	16.7
MALIGNANT	0	11	2	0	61.1	11.1
TOTAL	2	11	5	11.2	61.1	27.8

TABLE 6: TYPE OF RESECTION DISTRIBUTION

TYPE OF RESECTION	FREQUENCY			PERCENTAGE		
	RP	RP+ PMMC FLAP	RP + MICRO-VASCULAR FREE FLAP	RP	RP+ PMMC FLAP	RP + MICRO-VASCULAR FREE FLAP
SEGMENTAL MANDIBULECTOMY	1	11	3	5.6	61.1	16.7
HEMI MANDIBULECTOMY	0	0	2	0	0	11.1
MARGINAL MANDIBULECTOMY	1	0	0	5.6	0	0
TOTAL	2	11	5	11.2	61.1	27.8

TABLE 7: ADJUVANT RADIOTHERAPY DISTRIBUTION

ADJUVANT RADIOTHERAPY	FREQUENCY			PERCENTAGE		
	RP	RP+ PMMC FLAP	RP + MICRO-VASCULAR FREE FLAP	RP	RP+ PMMC FLAP	RP + MICRO-VASCULAR FREE FLAP
YES	0	4	1	0	22.2	5.6
NO	2	7	4	11.1	38.9	22.2
TOTAL	2	11	5	11.1	61.1	27.8

TABLE 8: TYPE OF MANDIBULAR DEFECT DISTRIBUTION

TYPE OF RESECTION	FREQUENCY			PERCENTAGE		
	RP	RP+ PMMC FLAP	RP + MICRO-VASCULAR FREE FLAP	RP	RP+ PMMC FLAP	RP + MICRO-VASCULAR FREE FLAP
CENTRAL (C)	0	0	0	0	0	0
LATERAL WITHOUT CONDYLE (L)	1	9	2	5.6	50	11.1
LATERAL WITH CONDYLE (H)	0	0	2	0	0	11.1
LATERAL WITH CENTRAL (LC OR CL OR LCL)	1	2	1	5.6	11.1	5.6
TOTAL	2	11	5	11.2	61.1	27.8

TABLE 9: TYPE OF RECONSTRUCTION DISTRIBUTION

TYPE OF RECONSTRUCTION	FREQUENCY	PERCENTAGE
RP	2	11.1
RP+ PMMC FLAP	11	61.1
RP + MICROVASCULAR FREE FLAP	5	27.8
TOTAL	18	100.0

TABLE 10: FACIAL APPEARANCE DISTRIBUTION

TYPE OF RECONSTRUCTION	GOOD	SATISFIED	ACCEPTABLE	DISSATISFIED	P-VALUE
RP	1	0	1	0	0.441
RP + PMMC FLAP	1	6	2	2	
RP + MICRO VASCULAR FREE FLAP	2	1	1	1	
TOTAL	4	7	4	3	

TABLE 11: SWALLOWING DISTRIBUTION

TYPE OF RECONSTRUCTION	GOOD	MILD DIFFICULTY	MODERATE DIFFICULTY	SEVERE DIFFICULTY	P-VALUE
RP	2	0	0	0	0.441
RP + PMMC FLAP	7	2	2	0	
RP + MICRO VASCULAR FREE FLAP	3	1	1	0	
TOTAL	12	3	3	0	

TABLE 12: TOLERANCE OF DIET DISTRIBUTION

TYPE OF RECONSTRUCTION	NORMAL DIET	SEMISOLID DIET	LIQUID DIET	TUBE FEEDING	P-VALUE
RP	2	0	0	0	0.865
RP + PMMC FLAP	7	3	0	1	
RP + MICRO VASCULAR FREE FLAP	4	1	0	0	
TOTAL	13	4	0	1	

TABLE 13: SPEECH DISTRIBUTION

TYPE OF RECONSTRUCTION	NORMAL	EASY TO UNDER-STAND	DIFFICULT TO UNDER-STAND	VERY DIFFICULT TO UNDER-STAND	P-VALUE
RP	2	0	0	0	0.171
RP + PMMC FLAP	2	4	5	0	
RP + MICRO VASCULAR FREE FLAP	2	1	2	0	
TOTAL	6	5	7	0	

TABLE 14: ACTIVITY DISTRIBUTION

TYPE OF RECONSTRUCTION	NORMAL	MODERATELY ACTIVE	MINIMALLY ACTIVE	PVALUE
RP	2	0	0	0.805
RP + PMMC FLAP	9	2	0	
RP + MICRO VASCULAR FREE FLAP	4	1	0	
TOTAL	13	3	0	

TABLE 15: OVERALL QUALITY OF LIFE DISTRIBUTION

TYPE OF RECONSTRUCTION	GOOD	FAIR	ACCEPTABLE	POOR	P-VALUE
RP	2	0	0	0	0.188
RP + PMMC FLAP	3	5	2	1	
RP + MICRO VASCULAR FREE FLAP	3	1	1	0	
TOTAL	8	6	3	1	

TABLE 16: RECIPIENT SITE INFECTION DISTRIBUTION

RECIPIENT SITE INFECTION	FREQUENCY	PERCENTAGE
YES	7	38.9
NO	11	61.1
TOTAL	18	100.0

TABLE 17: DONOR SITE INFECTION DISTRIBUTION

DONOR SITE INFECTION	FREQUENCY	PERCENTAGE
YES	1	5.6
NO	15	83.3
NOT APPLICABLE	2	11.1
TOTAL	18	100.0

TABLE 18: WOUND DEHISCENCE DISTRIBUTION

WOUND DEHISCENCE	FREQUENCY	PERCENTAGE
YES	7	38.9
NO	11	61.1
TOTAL	18	100.0

TABLE 19: FLAP NECROSIS DISTRIBUTION

FLAP NECROSIS	FREQUENCY	PERCENTAGE
YES	4	22.2
NO	12	66.7
NOT APPLICABLE	2	11.1
TOTAL	18	100.0

TABLE 20: FISTULA DISTRIBUTION

FISTULA	FREQUENCY	PERCENTAGE
YES	4	22.2
NO	14	77.8
TOTAL	18	100.0

TABLE 21: PLATE EXPOSURE DISTRIBUTION

PLATE EXPOSURE	FREQUENCY	PERCENTAGE
YES	5	27.8
NO	13	72.2
TOTAL	18	100.0

TABLE 22: PLATE REMOVAL DISTRIBUTION

PLATE REMOVAL	FREQUENCY	PERCENTAGE
YES	5	27.8
NO	13	72.2
TOTAL	18	100.0

TABLE 23: OCCLUSION DISTRIBUTION

OCCLUSION	FREQUENCY	PERCENTAGE
NORMAL	11	61.1
DERANGED	3	16.7
NOT APPLICABLE	4	22.2
TOTAL	18	100.0

TABLE 24: PAIN/ TENDERNESS IN TMJ DISTRIBUTION

PAIN/ TENDERNESS IN TMJ	FREQUENCY	PERCENTAGE
YES	1	5.6
NO	17	94.4
TOTAL	18	100.0

TABLE 25: DEVIATION IN MOUTH OPENING DISTRIBUTION

DEVIATION IN MOUTH OPENING	FREQUENCY	PERCENTAGE
YES	3	16.7
NO	15	83.3
TOTAL	18	100.0

TABLE 26: DESCRIPTIVE STATISTICS AND QUALITY OF LIFE

VARIABLE	MEAN VALUE	STANDARD DEVIATION
Age	49.61	17.28
QoL	14.611	3.38

TABLE 27: ASSOCIATION BETWEEN RADIOTHERAPY AND FACIAL APPEARANCE

RADIOTHERAPY	GOOD	SATISFIED	ACCEPTABLE	DISSATISFIED	df	P-VALUE
YES	0	1	3	1	3	0.026
NO	4	7	1	1		

TABLE 28: ASSOCIATION BETWEEN RADIOTHERAPY AND SWALLOWING

RADIOTHERAPY	GOOD	MILD DIFFICULTY	MODERATE DIFFICULTY	SEVERE DIFFICULTY	P-VALUE
YES	0	2	3	0	0.002
NO	12	0	1	0	

TABLE 29: ASSOCIATION BETWEEN RADIOTHERAPY AND TOLERANCE OF DIET

RADIOTHERAPY	NORMAL DIET	SEMISOLID DIET	LIQUID DIET	TUBE FEEDING	P-VALUE
YES	2	2	0	1	0.849
NO	11	2	0	0	

TABLE 30: ASSOCIATION BETWEEN RADIOTHERAPY AND SPEECH

RADIOTHERAPY	NORMAL	EASY TO UNDERSTAND	DIFFICULT TO UNDERSTAND	VERY DIFFICULT TO UNDERSTAND	P-VALUE
YES	0	1	4	0	0.035
NO	6	4	3	0	

TABLE 31: ASSOCIATION BETWEEN RADIOTHERAPY AND ACTIVITY

RADIOTHERAPY	NORMAL	MODERATELY ACTIVE	MINIMALLY ACTIVE	P-VALUE
YES	3	2	0	0.336
NO	12	1	0	

TABLE 32: ASSOCIATION BETWEEN RADIOTHERAPY AND OVERALL QUALITY OF LIFE

RADIOTHERAPY	GOOD	FAIR	ACCEPTABLE	POOR	P-VALUE
YES	0	2	2	1	0.010
NO	8	4	1	0	

TABLE 33: ASSOCIATION BETWEEN TYPE OF TUMOUR AND FACIAL APPEARANCE

TYPE OF TUMOUR	GOOD	SATISFIED	ACCEPTABLE	DISSATISFIED	P-VALUE
BENIGN	3	1	1	0	0.521
MALIGNANT	1	7	3	2	

TABLE 34: ASSOCIATION BETWEEN TYPE OF TUMOUR AND SWALLOWING

TYPE OF TUMOUR	GOOD	MILD DIFFICULTY	MODERATE DIFFICULTY	SEVERE DIFFICULTY	P-VALUE
BENIGN	5	0	0	0	0.239
MALIGNANT	7	2	4		

TABLE 35: ASSOCIATION BETWEEN TYPE OF TUMOUR AND TOLERANCE OF DIET

TYPE OF TUMOUR	NORMAL DIET	SEMISOLID DIET	LIQUID DIET	TUBE FEEDING	P-VALUE
BENIGN	5	0	0	0	0.611
MALIGNANT	8	4	0	1	

TABLE 36: ASSOCIATION BETWEEN TYPE OF TUMOUR AND SPEECH

TYPE OF TUMOUR	NORMAL	EASY TO UNDERSTAND	DIFFICULT TO UNDERSTAND	VERY DIFFICULT TO UNDERSTAND	P-VALUE
BENIGN	4	1	0	0	0.025
MALIGNANT	2	5	7	0	

TABLE 37: ASSOCIATION BETWEEN TYPE OF TUMOUR AND ACTIVITY

TYPE OF TUMOUR	NORMAL	MODERATELY ACTIVE	MINIMALLY ACTIVE	P-VALUE
BENIGN	5	0	0	0.611
MALIGNANT	10	3	0	

TABLE 38: ASSOCIATION BETWEEN TYPE OF TUMOUR AND OVERALL QUALITY OF LIFE

TYPE OF TUMOUR	GOOD	FAIR	ACCEPTABLE	POOR	P-VALUE
BENIGN	5	0	0	0	0.039
MALIGNANT	3	6	3	1	

TABLE 39: ASSOCIATION BETWEEN RADIOTHERAPY AND COMPLICATIONS

COMPLICATIONS		RADIOTHERAPY		P-VALUE
		NO	YES	
RECIPIENT SITE INFECTION	YES	3	4	0.031
	NO	10	1	
DONOR SITE INFECTION	YES	1	0	0.535
	NO	12	5	
WOUND DEHISCENCE	YES	4	3	0.268
	NO	9	2	
FLAP NECROSIS	YES	2	2	0.274
	NO	11	3	
FISTULA	YES	1	3	0.020
	NO	12	2	
PLATE EXPOSURE	YES	2	3	0.066
	NO	11	2	
PLATE REMOVAL	YES	2	3	0.066
	NO	11	2	
OCCLUSION	NORMAL	9	2	0.442
	DERANGED	3	0	
	NOT APPLICABLE	1	3	
PAIN/TENDERNESS IN TMJ	YES	1	0	0.535
	NO	12	5	
DEVIATION ON MOUTH OPENING	YES	2	1	0.819
	NO	11	4	

TABLE 40: ASSOCIATION BETWEEN TYPE OF RECONSTRUCTION AND COMPLICATIONS

COMPLICATIONS		TYPE OF RECONSTRUCTION			CHI SQUARE VALUE	P-VALUE
		RP	RP + PMMC FLAP	PR + FREE FLAP		
RECIPIENT SITE INFECTION	YES	0	5	2	1.393	.498
	NO	2	6	3		
DONOR SITE INFECTION	YES	0	1	0	.636	.727
	NO	2	10	5		
WOUND DEHISCENCE	YES	0	5	2	1.393	.498
	NO	2	6	3		
FLAP NECROSIS	YES	0	3	1	.706	.702
	NO	2	8	4		
FISTULA	YES	0	3	1	.706	.702
	NO	2	8	4		
PLATE EXPOSURE	YES	0	3	2	1.079	.583
	NO	2	8	3		
PLATE REMOVAL	YES	0	3	2	1.079	.583
	NO	2	8	3		
OCCLUSION	NORMAL	2	5	4	.709	.701
	DERANGED	0	2	1		
	NOT APPLICABLE	0	4	0		
PAIN/TENDERNESS IN TMJ	YES	0	1	0	.636	.727
	NO	2	10	5		
DEVIATION ON MOUTH OPENING	YES	0	2	1	.433	.805
	NO	2	9	4		

TABLE 41: ASSOCIATION BETWEEN TYPE OF TUMOUR AND COMPLICATIONS

COMPLICATIONS		TYPE OF TUMOUR	
		BENIGN	MALIGNANT
RECIPIENT SITE INFECTION	YES	0	7
	NO	5	6
DONOR SITE INFECTION	YES	0	1
	NO	5	12
WOUND DEHISCENCE	YES	0	7
	NO	5	6
FLAP NECROSIS	YES	0	4
	NO	5	9
FISTULA	YES	0	4
	NO	5	9
PLATE EXPOSURE	YES	0	5
	NO	5	8
PLATE REMOVAL	YES	0	5
	NO	5	8
OCCLUSION	NORMAL	5	6
	DERANGED	0	3
	NOT APPLICABLE	0	4
PAIN/TENDERNESS IN TMJ	YES	0	1
	NO	5	12
DEVIATION ON MOUTH OPENING	YES	0	3
	NO	5	10

* Statistical analysis was not possible for this correlation as one of the variables was constantly zero

TABLE 42: ASSOCIATION BETWEEN SIDE OF RESECTION AND COMPLICATIONS

COMPLICATIONS		SIDE OF RESECTION			CHI SQUARE VALUE	P-VALUE
		RIGHT	LEFT	CENTRAL		
RECIPIENT SITE INFECTION	YES	4	2	1	1.104	0.576
	NO	4	6	1		
DONOR SITE INFECTION	YES	1	0	0	1.250	0.535
	NO	7	8	2		
WOUND DEHISCENCE	YES	3	3	1	0.110	0.946
	NO	5	5	1		
FLAP NECROSIS	YES	2	1	1	1.290	0.525
	NO	6	5	1		
FISTULA	YES	2	1	1	1.290	0.525
	NO	6	7	1		
PLATE EXPOSURE	YES	3	1	1	1.700	0.427
	NO	5	7	1		
PLATE REMOVAL	YES	3	1	1	1.7	0.427
	NO	5	7	1		
OCCLUSION	NORMAL	5	5	1	0.525	0.769
	DERANGED	2	1	0		
	NOT APPLICABLE	1	2	1		
PAIN/TENDERNESS IN TMJ	YES	1	0	0	1.250	0.535
	NO	7	8	2		
DEVIATION ON MOUTH OPENING	YES	2	1	0	0.850	0.654
	NO	6	7	2		

TABLE 43: ASSOCIATION BETWEEN TYPE OF DEFECT AND COMPLICATIONS

COMPLICATIONS		TYPE OF DEFECT				CHI SQUARE VALUE	P-VALUE
		CENTRAL (C)	LATERAL WITHOUT CONDYLE (L)	LATERAL WITH CONDYLE (H)	LATERAL WITH CENTRAL (LC OR CL OR LCL)		
RECIPIENT SITE INFECTION	YES	0	6	0	1	2.097	0.350
	NO	0	6	2	3		
DONOR SITE INFECTION	YES	0	1	0	0	0.500	0.779
	NO	0	11	2	4		
WOUND DEHISCENCE	YES	0	6	0	1	2.097	0.35
	NO	0	6	2	3		
FLAP NECROSIS	YES	0	3	0	1	.607	0.738
	NO	0	9	2	3		
FISTULA	YES	0	3	0	1	.607	0.738
	NO	0	9	2	3		
PLATE EXPOSURE	YES	0	4	0	1	0.915	0.633
	NO	0	8	2	3		
PLATE REMOVAL	YES	0	4	0	1	0.915	0.633
	NO	0	8	2	3		
OCCLUSION	NORMAL	0	6	2	3	1.970	0373
	DERANGED	0	3	0	0		
	NOT APPLICABLE	0	3	0	1		
PAIN/TENDERNESS IN TMJ	YES	0	1	0	0	0.500	0.779
	NO	0	11	2	4		
DEVIATION ON MOUTH OPENING	YES	0	3	0	0	1.7	0.427
	NO	0	9	2	4		

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Annexure

SRI RAMAKRISHNA DENTAL COLLEGE AND HOSPITAL

DEPARTMENT OF ORAL AND MAXILLOFACIAL SURGERY

REVIEW PROFORMA

PATIENT NAME:

AGE/SEX:

DIAGNOSIS:

TREATMENT DONE:

ADJUVANT THERAPY:

I) QUALITY OF LIFE QUESTIONNAIRE:

1. FACIAL APPEARANCE:

	SCORE	PT VALUE
GOOD	4	
SATISFIED	3	
ACCEPTABLE	2	
DISSATISFIED	1	

2. SWALLOWING:

	SCORE	PT VALUE
GOOD	4	
MILD DIFFICULTY	3	
MODERATE DIFFICULTY	2	
SEVERE DIFFICULTY	1	

3. TOLERANCE OF DIET:

	SCORE	PT VALUE
NORMAL DIET	3	
SEMISOLID DIET	2	
LIQUID DIET	1	

4. SPEECH:

	SCORE	PT VALUE
NORMAL	4	
EASY TO UNDERSTAND	3	
DIFFICULT TO UNDERSTAND	2	
VERY DIFFICULT TO UNDERSTAND	1	

5. ACTIVITY:

	SCORE	PT VALUE
NORMAL	3	
MODERATELY ACTIVE	2	
MINIMALLY ACTIVE	1	

TOTAL SCORE: OVERALL QUALITY OF LIFE

- **GOOD**: 18 – 16
- **FAIR**: 15 – 13
- **ACCEPTABLE**: 12 – 9
- **POOR**: 8 – 5

II) POSTOPERATIVE COMPLICATIONS:

COMPLICATION	YES	NO
RECIPIENT SITE INFECTION		
DONOR SITE INFECTION		
WOUND DEHISCENCE		
FLAP NECROSIS		
FISTULA FORMATION		
PLATE EXPOSURE		
PLATE REMOVAL		
DERANGEMENT OF OCCLUSION		
PAIN/ TENDERNESS IN TMJ		
DEVIATION IN MOUTH OPENING		