

1-1-2003

The fabrication of a Maxillary Prosthesis and a Mandibular Implant-Retained Prosthesis

Chantel Le Roux
Peninsula Technikon

Recommended Citation

Le Roux, Chantel, "The fabrication of a Maxillary Prosthesis and a Mandibular Implant-Retained Prosthesis" (2003). *Tygerberg Dental Sciences*. Paper 24.
http://dk.cput.ac.za/tygerberg_ds/24

This Text is brought to you for free and open access by the Faculty of Health & Wellness Sciences at Digital Knowledge. It has been accepted for inclusion in Tygerberg Dental Sciences by an authorized administrator of Digital Knowledge. For more information, please contact barendsc@cput.ac.za.

**CASE STUDY ON
THE FABRICATION OF A MAXILLARY PROSTHESIS
AND A MANDIBULAR IMPLANT-RETAINED
PROSTHESIS:**

**By Chantal Le Roux,
BTech Student in Dental Technology.**

200003506

THE FABRICATION OF A MAXILLARY PROSTHESIS AND A MANDIBULAR IMPLANT-RETAINED PROSTHESIS:

By Chantal Le Roux

4th Year Student, BTech Degree in Dental Technology, Department of Dental Services,
Peninsula Technikon, Tygerburg, South Africa.

Keywords

Removable partial denture, Implant-retained denture, ball clasps, ball attachments

SUMMARY:

This article concerns a young male, who at the age of 28, was diagnosed with Osteosarcoma of the mandible. The article refers to the surgical procedures that were followed to eliminate the tumour and to fabricate the maxillary and mandibular prosthesis, thereby restoring the patient's masticatory efficiency and aesthetics.

The maxillary prosthesis fabricated was a removable partial denture retained with 2 ball clasps, whereas the mandibular prosthesis was a complete removable implant-retained denture that was secured to the implants by the use of 4 ball attachments.

INTRODUCTION:

This particular case study involves a young male patient with Osteo-sarcoma of the mandible.

The aim of this study was firstly to find the best possible solutions for eradicating the tumour and then to do so; secondly to determine which type of prosthesis would be most sufficient in restoring the patients masticatory efficiency and providing maximum and satisfactory aesthetics for the patient; and thirdly to actually fabricate the selected type of prosthesis for the patient.

PATIENT'S HISTORY:

The patient in this case study is a twenty-nine-year old, coloured male, who comes from the Stellenbosch area.

PATIENT'S MEDICAL HISTORY:

At a much younger age, the patient had his maxillary central and lateral incisors extracted for personal preference and not for any medical reasons.

In 1998 the patient received treatment at Tygerburg hospital, where a small tumour (classified as Juvenile Ossifying Fibroma) was surgically removed from his mandible (in the 3rd quadrant).

The patient was referred back to Tygerburg hospital in March 2001 as he had severe swelling in the anterior area of the mandible and chin (the 4th quadrant). The clinicians suspected that an abscess was responsible for the swelling as the patient's lower right canine (43), first premolar (44) and second premolar (45) was carious and

mobile. These teeth were successfully extracted with the reasoning that the swelling would relinquish.

However, the swelling persisted and the patient returned to the hospital in May 2001. The clinician expected pathology in the swollen anterior area of the mandible and thus the patient was sent for a scan and a biopsy. The results indicated that the patient had Osteo-sarcoma of the mandible (see figure 1).

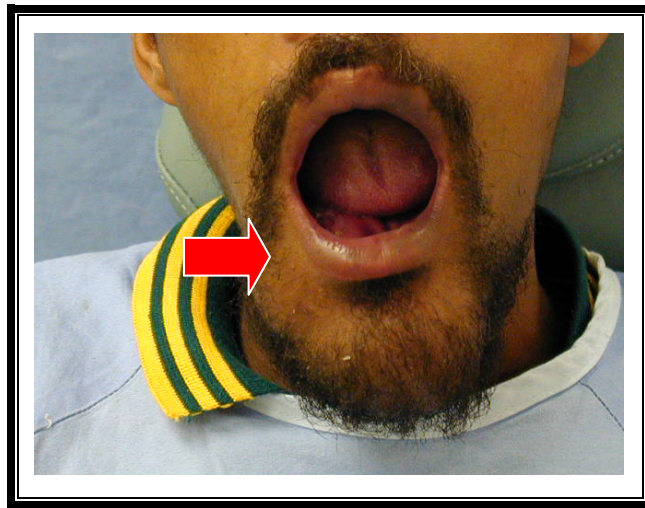


Figure 1: This is the patient and the arrow indicates the swollen area where the tumour is located

BACKGROUND RELATING TO OSTEO-SARCOMA:

Osteo-sarcoma is a very common type of tumour that is generally found in males between the ages of 20 –30. This type of tumour is not only restricted to the mandible it can also very easily occur in the maxilla.¹

Unfortunately the prognosis for Osteo-sarcoma is not very good, as 60 – 75% of the patients diagnosed with it, die after 5 years.¹

CLASSIFICATION OF OSTEO-SARCOMA:

It is very important to realize that Osteo-sarcoma is a type of tumour and not a type of cancer. A tumour is an abnormal tissue growth, which occurs in a specific area (in this particular case it was in the anterior area of the mandible).¹ The tissue cells in that specific area cannot stop regenerating and this eventually results in large lumps of tissues being formed that have the ability to put the vital organs and surrounding tissues under tremendous strain.¹

A tumour can be malignant or benign. Benign meaning that the tumour is a tissue-growth that is not harmful. Thus the tissue-growth does not infiltrate other body cells but merely regenerates at a rapid rate. A benign tumour can be removed without any harm to the patient and does not require chemotherapy or radiotherapy.¹

A malignant tumour, on the other hand is the regeneration of cancerous cells. These cells generally infiltrate the vital organs and surrounding tissues after which they begin to suppress the functions of these organs and tissues. A malignant tumour can be very dangerous as it can be fatal, thus it has to be removed as soon as possible. It also requires a number of either chemotherapy or radiotherapy sessions in order to eradicate any remaining cancerous cells.¹ In this particular case, the Osteo-sarcoma tumour was malignant.

SYMPTOMS OF OSTEO-SARCOMA:

There are a number of symptoms relating to Osteo-sarcoma, of which the follow are the most common and dominant. This type of tumour generally involves a great deal of swelling, which is mostly accompanied by pain and the loosening of teeth.¹ Because the swelling normally occurs at the supporting structures of the teeth, it tends to aggravate the supporting structures and eventually as a result of this aggravation, the tumour is able to infiltrate the supporting structures.¹

This infiltration then results in the loss of surrounding bone and soft tissue which in turn results in a loss of support for the teeth, thus leading to the loosening of the teeth.

Another common symptom of Osteo-sarcoma is parasthesia, which is the paralysis of the mandible. This occurs as a result of the infiltration of the tumour into the muscles of the mandible. ¹

CLINICAL TREATMENT OPTIONS:

Due to the fact that the Osteo-sarcoma tumour in this case was malignant, there was only one clinical treatment option, which was that the tumour had to be removed as soon as possible. The removal of the tumour involved the following surgical procedures:

- Firstly the patients had to undergo a radical mandibulectomy, which is the surgical removal of the infiltrated area of the mandible (see figure2).

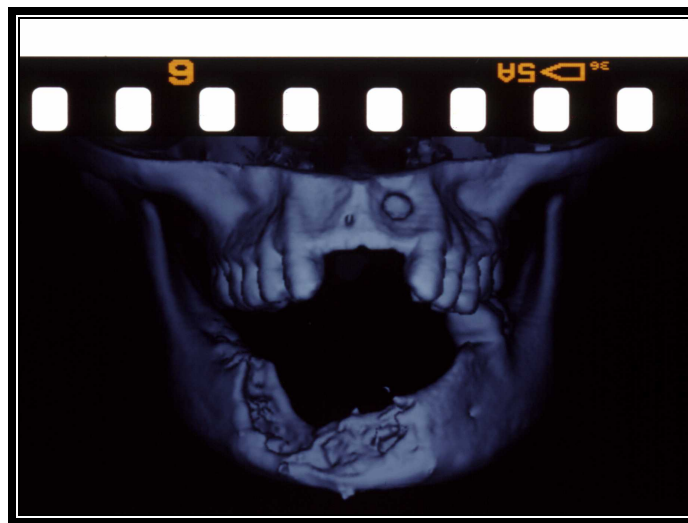


Figure 2: X-ray indicates the infiltrated area of the mandible which was removed.

- This was followed by a free fibula graft, where part of the patient's fibula from his left leg was removed and transplanted into his mandible. This section of new bone was secured in place with a number of small plates and screws.
- A skin graft was then performed, where skin from the patient's upper thigh was removed and used to replace the skin of the chin that had been removed with the infiltrated anterior area of the mandible bone.
- The patient then had to undergo several sessions of chemotherapy to ensure that all the cancerous cells were eliminated.
- Once the transplanted fibula bone had grown and attached itself to the remaining bone of the mandible, the screws and plates were removed.
- As a result of the mandibulectomy the patient had lost all of his lower teeth and his lower ridge was almost nonexistent. Thus the decision was made by the clinicians to place 4 implants (with a diameter of 3,75mm) in the anterior area of the patient's mandible.
These implants would ensure that the patient would have some sort of retentive mechanism for whatever type of prosthesis that was later to be fabricated (see figure 3).



Figure 3: 4 implants were placed in the transplanted bone (fibula bone) in the anterior area of the mandible.

- Once the implants had been placed, another surgical procedure had to be carried out. This procedure involved creating a sulcus in the labial area of the patient's mandible. This was also done for retentive purposes.

TECHNICAL TREATMENT OPTIONS:

MAXILLA:

As already mentioned, the patient had his maxillary central and lateral incisors extracted at a much young age for personal reasons. However, he now wished to have them replaced. There were 3 technical treatment options for achieving this, but whatever option was selected, the appliance would only replace the maxillary central incisors (11 and 12) as there was not enough space in the anterior area of the maxilla to replace all 4 of the original missing teeth.

1ST OPTION FOR MAXILLA:

The 1st option was an acrylic removable partial denture. This appliance would make use of one-armed clasps on the 14, 24, 16 and 26 for retention and would have full acrylic palatal coverage.

ADVANTAGES OF THE 1ST OPTION:

- ☐ This type of an appliance is easy to fabricate because of its simple design.²
- ☐ This appliance is light in weight because it is made of acrylic.³
- ☐ Removable partial dentures generally have a faster placement period when compared to other types of appliances.²
- ☐ This acrylic denture is relatively inexpensive to fabricate.

DISADVANTAGES OF THE 1ST OPTION:

- ☐ This appliance may not be very stable in the mouth because the acrylic base and the one armed clasps are flexible.²
- ☐ The wire clasps tend to wear and thus lose their retentive abilities.²
- ☐ The full palatal acrylic coverage does not allow for a natural feel in the patients mouth.³

2ND OPTION FOR MAXILLA:

The 2nd option was a cobalt-chromium removable partial denture with a horse-shoe palatal design. For retention, one-armed clasps would be placed on the 14 and 24, whereas Ackers clasps would be located on the 16 and 26. Proximal plates would be placed on the 13 and 23 for insertion guidance.

Cingulum rests would be placed on the 13 and 23, these together with the rests from the Ackers clasps (on the 16 and 26) would be used to resist biting forces.

Grid retention would be placed in the anterior area of the maxilla where the missing teeth were to be replaced.

ADVANTAGES OF THE 2ND OPTION:

- ☐ This type of appliance is generally very stable as a result of the rigid palatal area and the rigid clasps that are not easily displaced when biting forces are applied.²
- ☐ Cobalt chromium dentures are very durable, thus they can be worn for a long time.¹
- ☐ These sort of appliances are much more comfortable than acrylic removable partial dentures as the palate is only partially covered.³
- ☐ The cobalt chromium denture is also much more retentive than the acrylic partial denture as a result of the cast clasps.³

DISADVANTAGES OF THE 2ND OPTION:

- ☐ Cobalt chromium dentures are more expensive to fabricate than acrylic removable partial dentures.
- ☐ Their fabrication requires a certain amount of skill because the framework is cast in metal.
- ☐ Cobalt chromium dentures generally have longer placement periods than acrylic removable partial dentures.²
- ☐ There must be sufficient undercuts available for such an appliance.

3RD OPTION FOR MAXILLA:

The 3rd option was an acrylic removable partial denture with full palatal coverage and 2 ball clasps for retention. One ball clasp would be placed in the undercut between the 15 and 16; the other would be placed in the undercut between the 24 and 25.

ADVANTAGES OF THE 3RD OPTION:

- ☐ This appliance (like the 1st option) is easy to fabricate because of its simple design.²
- ☐ It is light in weight.²
- ☐ The placement period for such an appliance is much faster than the cobalt chromium denture.²
- ☐ It is inexpensive to fabricate. It is actually the cheapest of all 3 options.

DISADVANTAGES OF THE 3RD OPTION:

- ☐ Ball clasps tend to wear thus reducing the retentive ability of the appliance.
- ☐ The appliance has full palatal coverage, which allows for an unnatural feeling in the palate for the patient.³

TREATMENT OPTION MOST SUITABLE FOR MAXILLA:

The treatment option most suitable was the 2nd option, the cobalt chromium removable denture with the horse-shoe palatal design. This appliance is very retentive and durable. It is comfortable and stable, and because the palate is only partially covered the patient has the natural feel of his own palate. But unfortunately

this appliance was not used as it is rather costly to manufacture and the undercuts on the one side of the maxilla was not sufficient for the placement of such an appliance.

TREATMENT OPTION OF CHOICE FOR MAXILLA:

The option selected for use in this case study was option 3, the acrylic removable partial denture with the ball clasps. This appliance was selected as the appliance is able to utilize the limited undercuts to the fullest advantage, it is very simple appliance and therefore is easy and inexpensive to fabricate, it is also light in weight.

MANDIBLE:

Since the mandible was completely edentulous with only 4 implant in the anterior area, the decision was made that a complete removable denture would be necessary. However, the decision as to which type of attachment system would be used to retain the complete denture on the implants still had to be made. There was 2 options.

1ST OPTION FOR MANDIBLE:

The 1st option was a complete removable denture retained by using a bar and clip attachment system. The bar would be a mesio-bar, which had to be fabricated in the laboratory and secured to the 4 implants in the mouth, whereas the 3 prefabricated clips would be secured in the base of the acrylic denture (see figure 4).

ADVANTAGES OF THE 1ST OPTION:

- ☐ This type of an attachment system is easy for the patient to maintain.⁴
- ☐ The alloy used for casting the bar is generally not susceptible to corrosion.⁴
- ☐ This mesiobar allows for even distribution of masticatory forces.⁵

DISADVANTAGES OF THE 1ST OPTION:

- ☐ The plastic clips tend to wear easily. Thus they may require replacing every 2 to 3 years.
- ☐ This type of attachment system is expensive.
- ☐ The mesiobar is not prefabricated. It must be waxed up and cast in the laboratory by the technician. Thus, the fabrication procedure can be rather lengthy and accuracy is essential for a good fit.
- ☐ The bar and clip system required a sufficient amount of space between the mandibular ridge and the mandibular acrylic teeth.⁴
- ☐ Alignment of the implants is crucial for the mesiobar attachment.⁵



Figure 4: Photograph of a mesio-bar.

2ND OPTION FOR MANDIBLE:

The 2nd option was a complete removable denture retained with 4 ball attachments. The ball attachments would be secured to the implants and the 4 plastic clips that clip over the ball attachments would be secured in the acrylic base of the denture (see figure 5).

ADVANTAGES OF THE 2ND OPTION:

- ❏ Ball attachments are much cheaper than the mesio-bar and clip attachments.
- ❏ Less space is needed for the placement of the ball attachments.⁵
- ❏ Less laboratory work is required as the ball attachments come prefabricated.
- ❏ Alignment of the implant is not a crucial for the ball attachments.⁵

DISADVANTAGES OF THE 2ND OPTION:

- ❏ Clips tend to wear easily and may require replacing every 2 to 3 years.

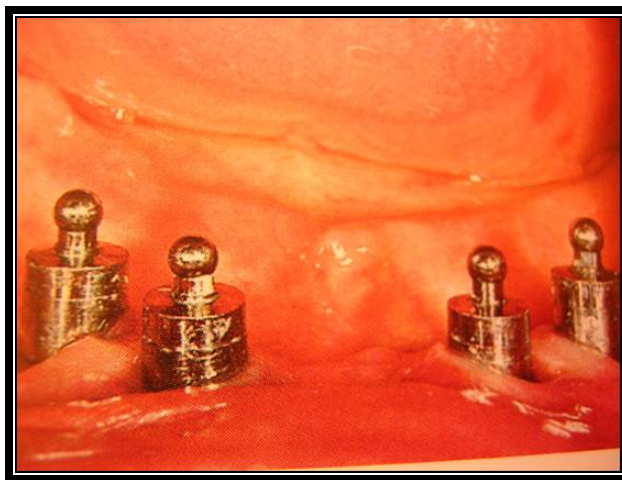


Figure 5: Photograph of the 4 ball attachments.

TREATMENT OPTION MOST SUITABLE FOR MANDIBLE:

The treatment option most suitable was the 1st option, that being the complete removable denture retained by the bar (mesio-bar) and clip attachment system. This attachment system provides good retention for the prosthesis, improved stability and it allows for the even distribution of masticatory forces

TREATMENT OPTION OF CHOICE FOR MANDIBLE:

The option chosen for use was the complete removable denture retained with the 4 ball attachments (which was the 2nd option); as the ball attachment system is less expensive than the bar attachment system, the alignment of the implants is not a crucial issue with ball attachments, less space is needed for their placement and they provide stability as well as sufficient retention.

LABORATORY PROCEDURES:

COMPLETED LABORATORY PROCEDURES:

- ☐ The 1st impressions (of both the patient's maxilla and mandible) were taken at Tygerberg hospital and sent to the laboratory where the primary models were poured in plaster of Paris.
- ☐ An upper partial special tray and a modified lower special tray with a window in the anterior area were constructed in light-cure material. The window in the lower special tray was to allow for space for the implants during the impression taking.

- ☐ These special trays were sent to the hospital where they were used to take the final impressions. Once the impressions were taken they were sent to the laboratory where the final models were poured in yellow stone.
- ☐ A lower record block (see figure 6) was then constructed on the lower model according to the standard measurements and was sent to the hospital, where it was used to record the patients bite registration.



Figure 6: Lower record block

- ☐ The bite registration was sent to the laboratory and was used to articulate the final models. The 1st try-in was prepared (which consisted of a partial upper and a complete lower) and with the use of the opposing upper model, proper occlusion was obtained by selective grinding on the lower artificial teeth.
- ☐ The try-in was then waxed up and returned to the hospital, where it was tried in by the patient.

☐ The lower try-in did not fit as a result of tissue that had grown over the implants. The tissues first had to be surgically removed before the lower could be tried in again. The upper try-in, however, did fit and was aesthetically correct. Thus it was returned to the laboratory where the ball clasps were adapter and placed in the interproximal undercuts between the 15 & 16 and the 24 & 25 on the model. The ball clasps where then secured to the upper try-in with wax and the labial flange was reduced, as it was to have a gum fit. The upper try-in was then flaked, packed, cured, trimmed and polished (see figure 7).

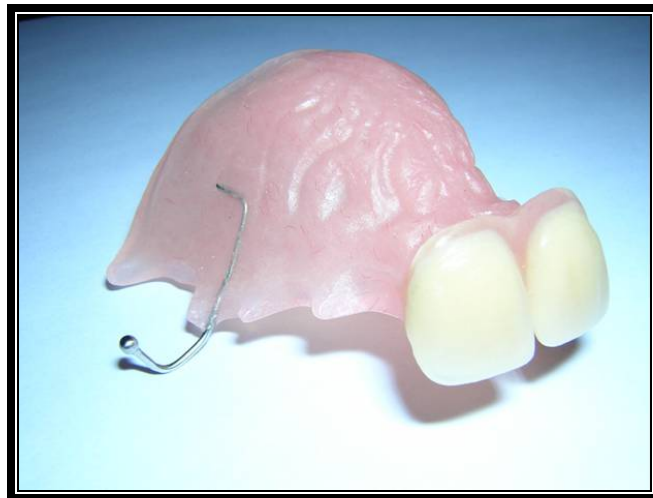


Figure 7: The finished maxillary partial removable denture, which is ready for placement.

☐ The tissue that had grown over the implants had to be surgically removed and to prevent it from growing over the implants again; a surgical stent had to be fabricated. This stent was fabricated from orthocryl and was approximately 3-4mm thick (see figure 8).



Figure 8: The stent

- ☐ Once the tissue had healed the stent was removed, however the tissue grew over the implants again, thus a 2nd stent had to be fabricated. This stent was slightly different from the 1st as the dentists had also decided to place the ball attachments onto the implants during the 2nd surgical procedure to remove the over-grown tissue.

Unfortunately the case study has only reached this point, and chances are that it will not be completed by the end of this year. However I would like to explain what laboratory procedures would be required to complete the case.

FUTURE LABORATORY PROCEDURES:

- ☐ Once the tissue has fully healed, the wax-up mandibular implant-retained denture would then be processed in the conventional manner, after which the retentive clips (which are used to attach the denture to the ball attachments) would then be secured into the base of denture.

- ☐ This will be done by grinding 4 holes in the fitting surface of the denture, roughly in the area where the implants are located. The denture will then be used to take a wash impression after which the laboratory analogs will then be inserted into the impression and model will be cast in yellow stone.
- ☐ The retentive clips will then be placed on the laboratory analogs, which are still secured in the denture, the denture will then be seated onto the model and small holes will then be drilled into the denture in its lingual aspect, through which the cold cure acrylic resin will be applied to secure the clips. The denture will then be placed in a pressure pot until the acrylic cures. If necessary the denture will be pumiced and polished (see figure 9).
- ☐ The completed appliance can then be placed.

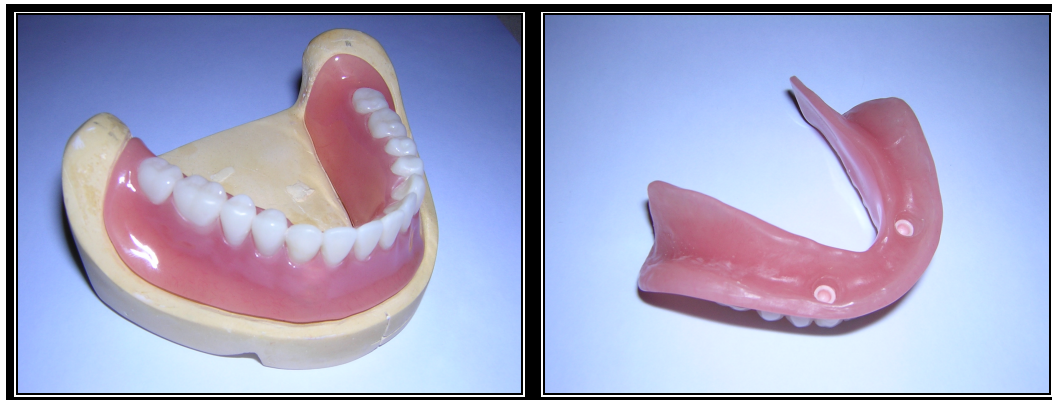


Figure 9: Photograph of what the completed mandibular implant-retained denture should look like, once it has been possessed.

CONCLUSION:

Due to the removal of the tumour together with decision to fabricate these particular types of prostheses, the patient will once again had full masticatory efficiency with the added advantage of improved aesthetics and the use of prostheses that are comfortable, durable and easy to maintain.

REFERENCES:

- 1.) K. Whaley. *Muir's Textbook of Pathology*. 15th ed. London: W.B. Saunders Company. 2001:215, 232.
- 2.) E.L. Miller. *Removable Partial Prosthodontics*. London: Williams and Wilkins. 1981:137-140.
- 3.) M. Johnson. *Modern Practice in Removable Prosthodontics*. London: W.B. Saunders Company. 1989:1-3.
- 4.) L.C. Howe, P.J. Palmer & B.J. Smith. *Implants in Clinical Dentistry*. Singapore: Kyodo Publications Ltd. 2002: 183-215.
- 5.) H.W. Preiskel. *Overdentures Made Easy: A Guide to Implant and Root Supported Prostheses*. London: Quintessence Publishing Co Ltd. 1998:90-94.