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## Research Article

# Tongue Function after Ablative Surgery of the Symphyseal Region of the Mandible for the Treatment of Ameloblastomas in Tanzanian Patients

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## ABSTRACT

A technique is described to reconstruct the symphyseal part of the mandible after a segmental resection because of ameloblastoma, while special attention was paid to fix the digastric and genioglossal muscles, so as to allow for normal tongue function. Twenty-two patients were followed for an average period of 30 months and all of them had normal tongue function and were able to swallow without problems.

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## Introduction

Reports from African studies show that ameloblastoma is the most commonly diagnosed odontogenic tumor in this part of the world [1-3]. The majority of these tumors occur in the mandible as compared to the maxilla and approximately 80% involve the symphyseal region [3]. It is generally agreed that, due to its aggressive behaviour, the best treatment of ameloblastoma is resection with a safe margin of healthy bone. The recommended safety margin varies from one to one and a half centimeters into radiographically healthy bone [4]. Resections of the symphyseal area of the mandible will inevitably go along with sectioning of the genioglossal and digastric muscles and, thus, will subsequently lead to impaired tongue function, including swallowing, when not re-attached. From the days of conventional preprosthetic surgery it is known that re-attachment of the genioglossal muscles, that were inadvertently cut at their insertion to the mandible because of deepening of the floor of the mouth, is notoriously difficult if not impossible. One of the authors (PS) has seen dramatic results of complete dissections of the genioglossal muscles, i.e. serious problems with swallowing and talking, that were very difficult to improve.

In Dar es Salaam, where all major oral and maxillofacial surgery in Tanzania is carried out, about 25 patients are seen every year with aggressive but benign odontogenic tumors, including ameloblastomas and odontogenic myxomas [1]. As many of these tumors spread over the midline of the mandible segmental resection of the symphyseal part of the mandible is often necessary, along with the part of the mandible at which the tumor has originated or extended. Since 2001, most patients, who had undergone a segmental resection for ameloblastoma, were immediately reconstructed using custom made pre-bend, Smart plates® and autogenous bone marrow grafts, mixed with platelets rich plasma (PRP). The details of this procedure have been presented previously [5, 6]. It is the aim of this report to present the results of a novel method to re-attach the dissected genioglossal and digastric muscles to the reconstructed symphysis of the mandible.

## Materials and Methods

During the period 2001 to 2016, fifty-five patients underwent a segmental resection of the mandible because of a benign odontogenic tumor of whom in 44 cases the symphysis was involved. The resection

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was followed by immediate reconstruction. In brief, the reconstruction began with harvesting of a cortico-cancellous bone graft from the anterior iliac crest. The size of this graft was approximately 5 by 5 cm or more, if possible. Additional cancellous bone was harvested from the donor site and attempts were made to harvest as much as possible. In some cases, where the resected bone measured more than 12 cm, grafts had to be taken from both (left and right) anterior iliac crests. The wounds were closed in layers in the usual fashion. Attention was then directed towards the stumps of the remaining mandible that were fixed with two long 2.3 mm titanium Smart plates® in the proper position, when applicable with the remaining teeth wired in occlusion. At this stage, the intraoral wounds were closed, using mattress sutures and single sutures or a running suture on top.

The wounds were subsequently rinsed with saline before attention was directed to the bone grafts. The harvested bone was particulated and mixed with autogenous PRP and activated with CaCl and thrombin, for which Tissucol® was used. This graft was then applied between the two titanium plates and the floor of the mouth. Where the periosteum was spared, the graft was placed between the two layers of periosteum, equally divided over the whole length of the defect. It was aimed to achieve a width of at least 8 mm. In case the symphysis was involved, the dissected stumps of the genioglossal and digastric muscles were tied together with a 2x0 Mersilene® suture and subsequently led through one or two holes of the lower plate or to one hole of both plates (Figure 1). This was done before the bone graft was applied and would, thus, run through the graft.



**Figure 1:** a) Genioglossal and anterior belly of the digastric muscles are tied together with a 3x0 Mersilene® suture and b) subsequently tied to both plates (arrow) after which the graft is applied.

All patients received, 24 hours before surgery and the subsequent 8 days, 500 mg Metronizadole® i.v. every 8 hours and one-gram Ceftriaxione® i.v. a day. They also received a naso-gastric tube through which they were fed during the immediate postoperative period for up to ten days, if necessary. Patients were followed up for as many years as possible. Special emphasis was put on the tongue function of those patients who had undergone a resection of the whole symphysis. This was done by asking them to stick out their tongue as far as possible and to touch the upper lip with the tip of their tongue from corner to corner. They were also asked whether they had any difficulty swallowing.

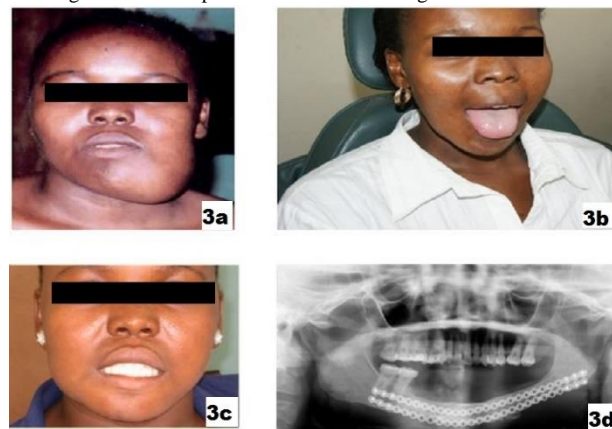
## Results

Of the 44 patients in whom the resection involved the symphysis, 22 patients (19 females and 3 males with an average age of 24.9 years) could be followed for more than 6 months postoperatively (6-72 months). Some of the other 19 patients had been back for follow-up previous to

the follow-up for this study but at that time no attention was paid to tongue function and others had never returned for follow-up beyond 3 months after discharge from the hospital. All 22 patients examined had a successful reconstruction and showed excellent tongue function in that they could all stick out their tongue far enough, while they could also curl their tongue and lick their upper lip (Figures 2 & 3). All patients were also able to swallow their food without any difficulty. There were no sensory deficits encountered in the tongue.



**Figure 2:** a) & b) Patient with ameloblastoma in the symphysis and right horizontal ramus of the mandible. c) Bone graft *in situ* with the pull suture tied to the plates. d) & e) Postoperative appearance and radiograph revealing a satisfying reconstruction. f) Patient is capable of sticking out her tongue and has no problems with swallowing.



**Figure 3:** a) Large ameloblastoma in the left horizontal ramus of the mandible extending into the symphysis. Four years postoperatively she has restored symmetry of the mandible and was able to stick out her tongue. b) & c) She had no problems swallowing. d) The radiograph shows excellent healing of the bone graft that measured more than 15 mm.

## Discussion

The results presented were very satisfying indeed, both from a functional and esthetic point of view. All followed patients had successful osseous reconstructions and were able to swallow and had normal tongue function. To the best of our knowledge there is no other study nor a technical note that deals with tongue function after ablative surgery of the symphyseal region in the context of surgical treatment of ameloblastoma. Symphyseal resections because of carcinoma of the floor of the mouth or gingiva are relatively seldom indicated because they can most of the time be treated with a marginal resection leaving

the thick lower part of the symphysis intact along with the insertions of the tongue muscles. This probably explains the almost complete absence of any study dealing with tongue function after mandibular symphyseal resection. The one study we found deals with seven cases in which a microsurgical radial forearm flap was used along with re-implantation of the resected bone that was treated with liquid oxygen [7]. The authors claimed good functional results without being specific about tongue function.

The reason for the successful outcome of the technique used is probably the incorporation of the muscle stumps in the bone graft and eventually the solid re-attachment once the grafts have healed. The initial attachment to the titanium plates with the 2x0 Mersilene® suture probably prevents the muscles to be pulled backwards during the first postoperative weeks. The feeding through the naso gastric tube in the first couple of postoperative days may also help to the initial attachment since patients do not have to swallow and thus, are not pulling on the muscles. An animal study would be necessary to test the validity of this assumption. This study also confirms again the validity of the concept of immediate reconstruction of the mandible after segmental resection with the use of 2,3 mm pre-bend Smart plates® and the application of a particulate autogenous bone graft mixed with PRP [5]. This technique is especially suitable in situations where there is no lack of soft tissue as is the case with most aggressive odontogenic tumors, including ameloblastoma and odontogenic myxoma. When compared with microsurgical techniques, it is probably less time consuming and goes along with less morbidity.

There is of course a serious drawback in this study in that only a little more than 50% of the patients could be followed for this particular reason. The follow up of patients in Tanzania, however, is notoriously difficult for several reasons. Firstly, most patients have to travel over great distances to reach Dar es Salaam and public transportation is not readily available in the more rural areas, necessitating them to first walk over considerable distances before they reach a bus or train station. Secondly, traveling is relatively expensive and for most patients not easily affordable. A little bit over 50% recall is, therefore, the best possible result, when taking into account the circumstances described. There is little reason to believe that the patients that were not followed up for this study would have a different outcome considering the 100% success rate in the group of patients that were seen for follow-up. Nineteen of them were followed up in the years preceding this study but not with the intention to check their tongue function.

Considering the results of a previous study, in which the quality of life of these patients were recorded, their tongue function must have been adequate [6]. The previous study has also shown a high degree of satisfaction despite the fact that many patients did not even receive a removable prosthesis [6]. Dental rehabilitation with implants and fixed prostheses would probably increase the quality of life significantly but is out of reach for these patients because of financial reasons. The situation has improved, however, considerably when compared with the days that no reconstruction was available for these patients, who were then left with severe deformation, known as the Andy Gump deformity. That was particularly annoying since most patients with ameloblastoma are in their 2nd to 4th decade of life [1-3].

## Ethical Approval

The study was conducted in compliance with Good Clinical Practices and in accordance with the “Declaration of Helsinki.” Ethical clearance to conduct this study was granted by the Research and Publications Ethical Committee of the Muhimbili University of Health and Allied Sciences (MUHAS).

## Consent

Written informed consents for participation in the clinical study were obtained for all participants.

## Acknowledgements

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## Availability of Data and Materials

The complete data and materials described in the case report are freely available from the corresponding author on reasonable request.

## Author Contributions

The authors have contributed equally to this work by making substantial contributions to the conception and design, acquisition of data, and analysis and interpretation of data as well as being involved in drafting of the manuscript or revising it critically for important intellectual content. All authors read and approved the final manuscript.

## Source Support

2,3 mm Smart® plates were provided by KLS Martin.

## Competing Interests

None.

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