CASE REPORT

Mandibular reconstruction with an alloplast: A case report and review of the current literature

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ABSTRACT

The mandible plays a major role in definition of lower facial contour, airway protection and support for the tongue, dentition and the muscles of the floor of the mouth. Interruption of mandibular continuity, therefore, produces both cosmetic and functional derangements. The restoration of a patient, therefore, into acceptable cosmetics and satisfactory function after surgical ablation is a challenge for the oral and maxillofacial surgeon. This was a case of composite post-ablative defect which was reconstructed with a non-biological material (alloplast). The alloplast got exteriorised intraorally within a period of 1 year with resultant infection and had to be removed. It was concluded that alloplasts served only as temporary stabilisation in delayed reconstructtion of mandibular continuity defects. The reasons for delay may, however, vary. Resource development is necessary to facilitate surgical skills acquisition in free microvascular techniques of reconstruction which offers better and sustainable outcomes.

Key Words: Alloplasts, free- flaps, reconstruction

INTRODUCTION

The mandible is a U-shaped, 3-dimensional bone that articulates with the base of the skull at the condyles by two synchronously functioning synovial joints called the temporomandibular joints. It forms in two halves which fuse in the midline to form the symphysis menti. Its component parts, apart from the already mentioned, include the ramus, body, alveolar and coronoid processes. The teeth, 16 per quadrant in adults, are socketed within the alveolar processes. It is the only load bearing bone in the skull that withstands forces generated at the teeth, condyles and from muscular attachments during masticatory function. The bone carries a functional neurovascular bundle which supplies sensory innervations and nourishment to all standing teeth, lip and chin. This aforementioned anatomy confers a uniqueness and complexity on the mandible, both from a functional (muscular attachments, sensory innervations and dentition) and cosmetic (symphyseal curvature and gonial angle) perspective in reconstructive attempts.

Mandibular configurational defects are as a result of gunshot wounds (trauma), cancrum oris, osteomyelitis (infection) and may be post-ablative. Such defects affect both function and appearance. They have far reaching consequences when a semblance of normalcy cannot be restored to the patient. A poor cosmetic profile is just as unacceptable as functional problems that include poor masticatory ability, affected deglutition, excessive drooling of saliva and loss of neural function. These result in an overall drop in the quality of life (QoL) of such patients. A post-ablative defect may also result in a composite loss

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of tissues particularly in mandibular malignancies with soft tissue involvement. The challenges of reconstruction, therefore, mandate that an ideal reconstructive technique be deployed in restoring the patient back to normalcy. An ideal reconstructive technique must restore form and function, be within the expertise of the surgeon with minimal or no donor site morbidity, nil infection/rejection/toxicity and must be affordable for the patient. However, there is no single technique that fulfils all these criteria.

The paper aims to share this experience at mandibular reconstruction using a bio-inert, non-biological material. Concise review of relevant literature on current concepts in the management of mandibular continuity defects was done to highlight management protocols in more developed centres.

CASE HISTORY

A 45-yr-old male reported at the clinic on 17/01/2011 with a 25-year history of anterior mandibular swelling. He claimed the swelling was initially small but grew progressively to the present size.

His medical history was non-contributory.

On examination, he was a healthy-looking man with a massive anterior jaw mass which measured about 12 × 15 cm [Figure 1]. The swelling measured from the left mandibular angle to the contralateral angle with multiple indurated ulcers that had rolled and everted edges. He had no cervical lymphadenopathy. The jaw swelling was firm in consistency and was attached to the overlying skin in the region of the ulcers, which suggested extensive soft tissue involvement. He had a positive history of traditional intervention.

The intraoral examination revealed the presence of a large expansile anterior mandibular swelling which extended to the region of the third molars bilaterally. The buccal sulci on either sides were completely obliterated with bilateral lingual plate expansion. All teeth on the lower right jaw quadrant had spontaneously exfoliated except 7 and 8 and in the lower left quadrant, 1 and 2 were also missing. The lower left canine was mobile in the 3rd grade. The tongue and palate were clinically normal.

An impression of ameloblastoma was made which was supported by radiological findings. The radiographs confirmed the clinical suspicion revealing a multilocular jaw lesion [Figure 2] extending from the angle on the right to the same on the left side. The roots of the standing teeth were unsupported by bone with associated displacement of many. A biopsy confirmed the lesion was an ameloblastoma of the plexiform type.

He was taken to the theatre on 15/06/201l and had a resection of the mandible and all involved soft tissue via a visor approach. The residual mandibular continuity defect was reconstructed using angled stainless steel reconstruction plate anchored with 2.5 mm screws to the residual mandibular stumps [Figure 3]. The residual soft tissue defect was closed as primarily as possible leaving a 7 × 9 cm area of full-thickness soft tissue defect through which the reconstruction plate was visible. This defect was reconstructed using a pedicled deltopectoral flap raised from the left anterior chest wall. All incisions were closed in layers and the patient was reversed, recovered, and returned to the ward. He was discharged home approximately 2 weeks after admission. Five months post-operatively, he complained of pain from the anterior lower jaw region and intraoral extrusion of the implant. A conservative approach was adopted by undermining and suturing for closure, the oral peri-implant soft tissue, under local anaesthesia. He was reassured and discharged

Figure 1: The patient's pre-operative photograph

Figure 2: Oblique lateral plain radiograph showing a multilocular, osteolytic jaw mass

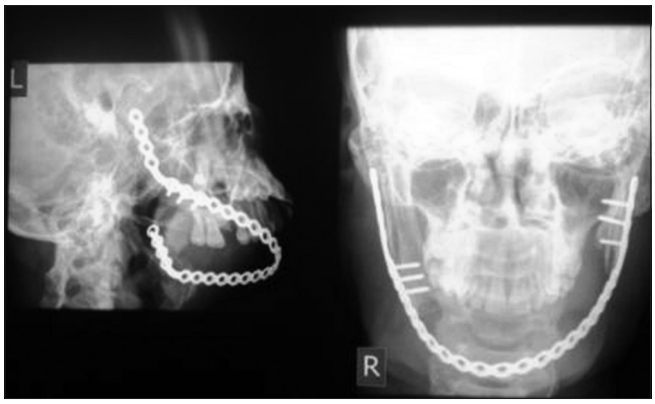

Figure 3: Plain radiographs showing the alloplast *in situ*

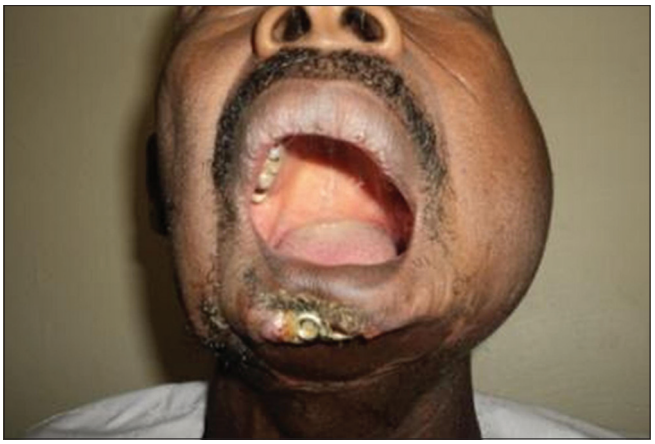

Figure 4: Alloplast exteriorisation with orocutaneous fistula

home with antibiotics and analgesics. On subsequent review appointments he was apparently well with no complaints. Approximately a year after ablation and reconstruction, he presented with complaints of pain and ulceration from around the midpoint of his chin. Examination revealed an ulceration of the soft tissue at the point of the chin through which a portion of the alloplast protruded with an oro-cutaneous fistula [Figure 4]. A diagnosis of soft tissue infection secondary to the presence of a foreign body was made and the alloplast was subsequently removed under general anaesthesia.

His 2-year post-ablative review has been satisfactory except for a residual configurational defect of the lower jaw and attendant functional problems.

DISCUSSION

The principles and techniques of mandibular reconstruction have evolved dramatically over the years. Refinements in techniques continue to improve patient's QoL.[1-3]

Reconstruction plates are rigid plates (stainless steel or titanium) that are applied along the lower border of the mandible. They were made with the intention of bridging a defect[1,4,5] stabilising remaining segments, and maintaining occlusion and facial contour.[1,4,5] They are presently used to fix non-vascularised cortico-cancellous blocks or vascularised bone grafts to the remaining mandible.[1-5] The benefits of their use include, avoidance of donor site morbidity,[1,2] reduced operating time[3,4] a cheap and affordable approach to reconstruction.[4,5]

Among its disadvantages include intratissue electrolytic activity which makes them prone to tissue rejection.[4,5] Titanium has been introduced to eliminate this problem of biocompatibility but with the attendant increased cost.[1,4,5] Other disadvantages include susceptibility to soft tissue dehiscence with exteriorisation of the plate following adjuvant therapy,[4,5] (irradiation), plate fracture,[1,2] infection from loosened plate and/or screws[2,3] and unsatisfactory facial contour.[2] This result is an anecdotal evidence that plate-only approach do not provide long-term satisfactory result in mandibular reconstruction. Studies have shown that extrusion is the most common complication of mandibular reconstruction using these plates, with an incidence of about 20-48%.[1,5,6] Conventional mandibular reconstruction techniques have evolved from plate –only/ plate-corticocancellous non-vascularised bone grafts with or without the use of pedicled flaps to more sophisticated techniques. Such include genetic therapy using recombinant human bone morphogenic protein (rhBMP) "to grow" a new mandibular segment, modular endoprosthesis and Tranport Disc Distraction Osteogenesis (TDDO).[1] The clinical applicability of these techniques at present is minimal as it is still in the experimental stages.

According to Boyd's[6] criteria, a mandibular reconstruction plate fails whenever it has to be removed due to exposure, infection or fracture and the overall success rate has been documented to be between 61 and 71%.[7,8] Most failures are commonly associated with anterior or large lateral mandibular defects involving the condyle[4,9] poor soft tissue coverage[5,10-13] and when patients have been subjected to pre- or post-operative radiotherapy.[10,12] Currently the use of such bridging plates has been superseded by advanced techniques in free microvascular transfers in view of superior functional and aesthetic outcomes.[2,3,7,9] Their use in highly developed centres with high volume reconstruction surgeries is limited to transfixation of virtually contoured osteotomised free vascularised bone segments to provide rigid immobilisation[2,3,7,9,10,13]

Free microvascular transfers involves the use of free vascularised bone harvested from distant sites with

or without a composite soft-tissue paddle carrying its own vascular supply and anastomosing this supply to the vascularity of the recipient bed during insetting.[1-3] This ability to transplant living tissue from one region of the body to another has created a realistic and clinically applicable approach to the reconstruction of complex defects of the head and neck region. Introduced in 1960s and popularised in the United States in 1980s and 1990s,[14] its overall success rate has improved significantly and is currently 95-99% among experienced surgeons in single-stage reconstructions.[7,9,10,14] Vascularised bone flaps, in general, provide the best functional and aesthetic outcome compared to non-vascularised options like plate-only and non-vascularised bone grafts.[1,7,13] The main advantages of this technique include, improved vascular supply,[10] (which is vital for wound healing), unrestricted positioning from a large variety of donor sites[7,8] the large amount of composite tissue available,[10,11] the limitless potential for functional reconstruction[7,9,11] (sensory/motor functions) and the potential for reconstruction of the dentition by placement of osseointegrated implants.[1-3] Microvascular free flaps further allows for tissue augmentation of the head and neck with restoration of symmetry without the problem of atrophy or resorption.[9,10-15]

Commonly used microvacular tissues in mandibular reconstruction include fibula, iliac, scapular and radial osteocutaneous flaps[8,10,13] with the free fibula flap being the most versatile.[14,15] Popularised by Hidalgo *et al.*,[14] in 1989, among its many advantages include, a long segment that can be osteotomised (20-25 cm) without compromising blood supply[15,16] a sizeable and lengthy pedicle (2-3 mm, 15 cm),[16,17] making for easier and safer anastomotic integrity. It can also be harvested with a muscular component, if required and neurotisation is possible using the lateral cutaneous sural nerve for sensation.[10,13-21] The major disadvantage of microvascular flap reconstruction, however, is technique sensitivity with little margin for error and an attendant need for expensive microsurgical equipments.[13,16,17] There is also a stringent need for optimal patient status which equips the patient against the rigors of a lengthy surgical procedure, blood loss and fluid shifts.[10,13] In view that free microvascular flaps have a higher success rate, a shorter hospital stay and require fewer additional procedures than conventional approaches, the longer operating time and greater technical complexity associated with it is justified.[2,9] Cordeiro and Hidalgo[9] reported low success rates of plate-only reconstruction ranging from 34% at 6 months to 64% at 1-year follow-up. Plate viability was further reduced by radiation therapy and in their opinion plate- only reconstruction is prone to failure. They opined that the plate become exposed in many instances, leading to complications such as infection and orocutaneous fistulae that may necessitate a second salvage surgery to remove the armamentarium. This has been corroborrated by several other reports.[1,4,21,22] Our experience is similar, although the validity of our observation is not as strong in view of limited sample size.

Based on these proven facts plate –only or plate/ non -vascularised graft reconstruction should be reserved for patients with existing comorbidities who cannot withstand lengthy surgeries[1,2,4,13,22] or as a salvage procedures when vascularised flaps fail[2,21,22] or where there is no microvascular expertise.[2,10]

Conclusively, patients requiring mandibular reconstruction currently have much better outcomes. Vascularised bone flaps are the best option for a functional and aesthetic reconstruction, with the free fibula flap remaining the gold standard for mandibular reconstruction.

This paper is an advocacy to the hospital management in view of acquisition of armamentarium and human resource development to make free microvascular tissue transfers for craniofacial reconstruction feasible at this centre.

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