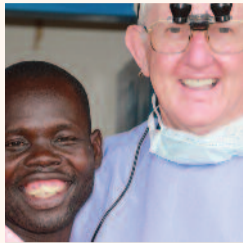


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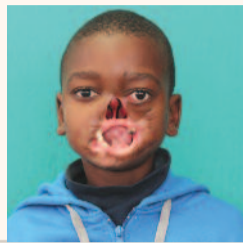
Vol. 1, No. 1



## AFRICAN NEWS

A Congolese Dental School - creating change six students at a time!

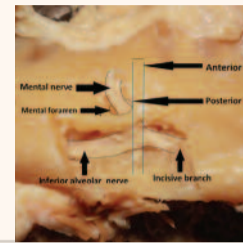
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## Live surgery performed for the first time at a dental congress in South Africa - Nomads 2017

By DTI

**JOHANNESBURG - South Africa:** The annual Nomads Congress is regarded as one of the most anticipated events on the South African dental calendar. Not only does it attract delegates from the whole of South Africa, but also from neighbouring states. This year saw participants from Uganda, Ethiopia, Zimbabwe, Namibia, Swaziland and Botswana.

Presented by Nomads, the South African Society of Endodontics & Aesthetic Dentistry, the Congress has developed a solid reputation for its innovative programme, featuring top national and international speakers. Aimed at the entire Dental Team, a wide range of topics - including endodontics, aesthetics, restorative dentistry, implantology, anaesthesia, CAD/CAM - are offered.

Nomads 2017 saw the inclusion of live surgery for the first time at a South African dental congress. In two separate procedures, a root canal treatment and a single implant placement were performed. The logistics behind these presentations were complicated - a fully-equipped 'surgery' had to be built in the auditorium, complete with dental chair, imaging\* and scanning equipment, cabinetry and compressor. To show the procedures in close-up on the big screen, audio-visual requirements included a mi-

croscope, video camera with operator and a link to the main projector. The clinicians involved were specialist Endodontist, Prof Peet van der Vyver and specialist Oral Surgeon, Prof Andre van Zyl, and their teams, of whom most were dental specialists.

**Dental Tribune asked Prof Andre van Zyl, Head: Dept of Periodontics and Oral Medicine, University of Pretoria, to give a surgeon's perspective on being part of this novel event:**

"When I was first approached to do live surgery for the Nomads 2017 Congress, I immediately agreed and was excited. Only when I started playing the scenario through in my mind did the reality sink in and the magnitude of trying to present this dawned on me.

The patient would be identified to the audience as he/she would be in the audience and this posed many ethical questions and would clearly be a very stressful situation for any patient. In fact, no-one had experienced such a scenario in South Africa before.

What if the patient developed something as common as a vasovagal syncope? We realized that a medical specialist would have to be on hand for any eventuality, from managing a nervous reaction to a potential life-threatening episode.

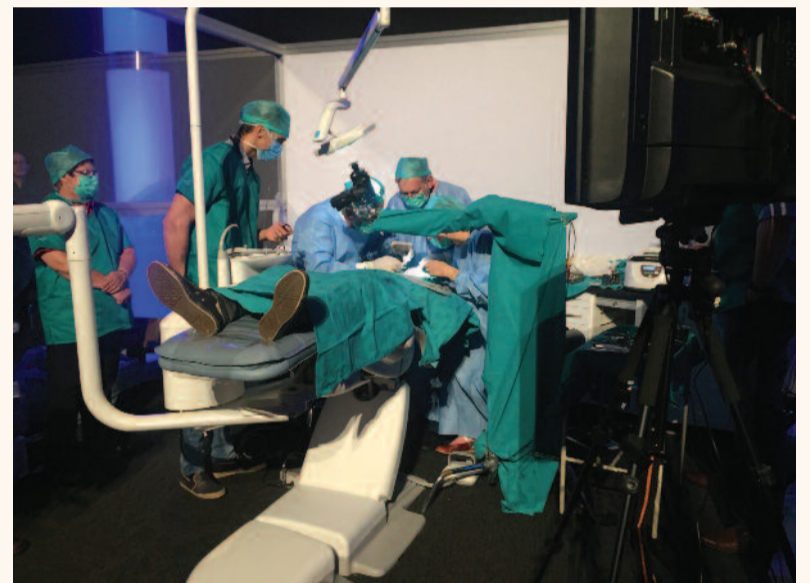
The logistics to cover these situations is daunting to say the least.

I have done many live surgical procedures on camera through the last 20 years - but always from within the safety of a fully equipped practice, behind a camera, instead of more than 300 delegates watching. Delegates could never watch us perform in a cubicle, and it made me think of animals in a cage. Not a happy picture for us.

When doing surgery in the safety of a hospital environment, I can ask for anything and it will be fetched from sterilization, but in an auditorium, I would have no back-up. What if I that were 50km away in my department? A LASER to stop arterial bleeding? The mind boggles at all possible scenarios.

Two days beforehand we found out that no proper suction could be installed in an auditorium, and a mobile suction would be used. This proved to be inadequate in strength, but thankfully our patient hardly bled during the operation.

While performing the procedure,, we experienced two serious issues never thought of in the planning. The first being that the 'surgery' was exceptionally hot with all the sterile clothing, and no air-conditioning. Secondly, and even worse, was that the auditorium was dark and we



could not see our instruments outside the extremely bright LED operating light! Assistants had to quickly use cell-phone torches to show the instruments. This made me think of a famous heart surgeon who was a patient and who told us how he and his team operated by cell-phone screen lights (not the current torches) many years ago with the first rolling black-outs and no generator kicking in! No newspaper had that story!

Other challenges were the two patients who cancelled and we had to suddenly find a replacement just days before the congress and the planned CAD/CAM section could not take place as we had to close the

bone-augmented implant as fast as possible. All part of the fun of trying something new.

At the end I have to commend the Nomads organizing committee for such a courageous step to bring a new dimension to congresses in South Africa. I am not sure how many takers they will have next time. Perhaps younger clinicians will step up to the plate. With overhead lighting, a larger surgery-room and air-conditioning and lessons learnt in 2017, it will be an easier delivery."

**Thank you, Prof van Zyl, for sharing your insight.**

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# A Congolese Dental School - creating change six students at a time!

Dr Graham Toulmin AM and his wife Wendy, also an AM, began developing dental work in the Democratic Republic of the Congo (DRC) when it was known as Zaire and ruled by the dictator President Mobutu Sese Seko. Their family with 4 small boys lived there from 1987 till 1991 and then, with the country undergoing massive inflation and breakdown of law and order, with a coming civil war brewing, and after two evacuations to Kenya in two months, the family returned home. However Graham began doing short term visits to help the clinic, named after his wife – Clinique Dentaire Mama Wendy – to survive. And survive it did, through two civil wars that caused the deaths of 5 million people, because of the faithfulness and courage of the three dental officers, Timon, William and Ringo, that Graham had trained in his early years there.

In 2014, with retirement in his sights, Graham had an anonymous donor come forward with a large donation to fund the building of a dental training institute in Aru, 600 kms to the north of the Mama Wendy clinic. This was a strategic move in a country still unstable in some regions as the clinic-institute would be close to the Ugandan border and safer than some places in eastern DRC.

With government approval for a course that was aiming to turn out dentists with practical and clinical competencies, Ringo, with nursing qualifications in his background, enrolled as he had been trained by Graham and others as an 'apprentice' and although he had worked for 20 years as a dentist, the government was now demanding government-approved qualifications. The problem the founding dental school encountered was that there were no qualified teachers of dentistry available to head up the work in this area of DRC. Graham and Wendy, in visiting Aru with Keith Mentiplay to plan the building in September 2016, saw the state of teaching by non-dental personnel (the students were carving teeth out of soap and cutting cavities with scalpels as their practical work) and felt they needed to help.

They had no idea of the immensity of the task ahead of them as Graham was made 'Chef du Section Dentaire' and Wendy, by default, fell into the task of Administrator and Bursar with Building supervision on the side. The last two years were pretty tough,



especially teaching dentistry in French and surviving with basic living conditions of no water supply or electricity, but they both somehow managed and the Dental Institute was opened on the 12th November 2015 to great fanfare in the community. The first group of students graduated in July 2016 with Ringo the top student in the whole superior training institute, the second group in July this year, and in October 2017, 6 new students began a revised and more practical three year dental course focusing on competencies in the clinic and problem-based learning.

The Dental Institute is unique in Congo. It has 8 fully functioning Adec 500 chairs which Keith Mentiplay installed and which a young technician that he trained, continues to maintain. It has a dental laboratory, sterilisation room, offices and classroom/library, waiting room and reception, two external generators and a water supply from tanks. It is a million dollar dental clinic funded and supplied from Australia and it is now self sufficient. There really is nothing like it in the whole country of DRC, which is the size of Western Europe, and where well-trained dental practitioners are few and far between.

The general population in the country live in tremendous poverty with many health issues, political challenges including dangerous

militias and rebel groups in some eastern parts of the country and the dental problems that come along are never simple. Often one mandibular fracture a week due to motor bike accidents and no helmets.

Until Dr Toulmin arrived, there was little to no hands-on training for future dentists except in the capital 2000 kms away but even that had 400 students but only 7 chairs, often not working. Thus students were forced to learn a theory-based syllabus and would graduate never having given an injection, done an extraction or a restoration. This is a recipe for disaster when presented with a live human patient!

After their 2 years away, Graham and technology-savvy Wendy have returned to Sydney for a month with many fabulous war stories to tell. These include some daily struggles like not having the creature comforts we are so used to here in Australia, like running water, all the way to bureaucratic hurdles needed to be 'jumped' for appropriate visas for visiting dentists. Even in their downtime there are jobs to be done! In June after the students finished their exams, they were flown to Garamba National Park where over 2 days they examined and treated 86 of the 250 Park Rangers who patrol the park and protect the elephant population (1347) from poachers. These valuable rangers also protect the local

community from the Lord's Resistance Army (a rebel group and vicious religious cult who have committed atrocities in Northern Uganda, South Sudan, the Central African Republic and the DRC). Without their visit these important community members would have no access to dental care.

Their month long visit home to Australia was busy with speaking engagements, seeing friends and sponsors, sourcing supplies for the clinic, getting replacement parts unavailable in Uganda or Congo and getting medical tests. Wendy met up with Henry Schein Halas technicians to systematically work through how to get the Aru OPG machine working and this will be the first OPG in eastern Congo for more than 1000 kms. Graham and Wendy were very grateful for the dental supplies and teaching resources that Henry Schein Halas was able to provide and lunch with Gordon Anderson and Jessica Chasen a highlight. The work has moved ahead with the help of Henry Schein Halas over the last twenty years, an aid project that hasn't crashed and burned, and in March 2018 will celebrate its 30th anniversary. The Toulmins have returned to Congo for a final two years to begin the transition to Congolese leadership and self-sufficiency and we look forward to hearing their news when they return.



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# Interview: “The Italian dental industry is in a very healthy condition”

Nov 16, 2017

By Dental Tribune International

Driven by an emphasis on high-performing and intelligently designed products, the Italian dental industry has become firmly established as one of the largest in the world. Dental Tribune International spoke with Dr Maurizio Quaranta, former president of the Italian association for dental dealers (Associazione Nazionale Commercio Articoli Dentali; ANCAD) and current Vice President of the Association of Dental Dealers in Europe, about some of the recent activity in Italy's dental industry.

## Dr Quaranta, how would you assess the current state of the Italian dental industry?

The Italian dental industry is in a very healthy condition. It currently employs over 3,300 people and generates an annual revenue in excess of €880 million. Much of this revenue—about 60 per cent—is achieved through exports, as Italian-made dental products are increasingly being recognised for their reliable and durable components, innovative technological solutions and aesthetically pleasing design. In addition, there has been a surge in investments by domestic dental practices and dental laboratories in the research and development of locally made products and equipment. Overall, the industry is on the upswing.

## Expodental Meeting took place this May and ended on a high note. How did the event reflect the current state of the Italian industry?

As the premier event for the Italian dental industry, Expodental Meeting allows visitors to find out about the latest product innovations, training opportunities and much more all in one place. With 281 companies exhibiting and more than 18,000 dental professionals visiting, the overall attendance was 20 per cent higher than in 2016. It was the second Expodental Meeting and the growth in the exhibition's size demonstrates how much the Italian dental industry is growing itself.

## What is the role of the Italian Dental Industries Association (UNIDI)?

Set up in 1969, UNIDI today represents the majority of Italian dental manufacturers. Its purpose is to promote the “Made in Italy” label and to guarantee that its members produce high-quality products that are compliant with current Italian and EU regulations. UNIDI's promotional activities are focused on two major international events: Expodental Meeting and the International Dental Exhibition Africa, the only international trade show for dental professionals in all African countries.

## ANCAD emphasises a strong code of ethics. What does this code entail?

The code contains many guidelines,

but perhaps the most important one is to remind dental dealers that their primary objective is to supply high-quality products and services. Profit

is only one of the aims of doing business—we want our members to build partnerships with their customers that are based on trust and

mutual satisfaction. The code also requires dental dealers to act in accordance with governmental laws and regulations.

Thank you very much for the interview.



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# Mechanically-retained facial prosthesis for a large defect following Cancrum Oris: a clinical report

By Avish J. Jagathpal,<sup>1</sup> Ashana Harryparsad,<sup>2</sup> Rajesh Doolabh<sup>3</sup> and Benjamin F. Calitz<sup>4</sup>

## Abstract

Retention is of critical importance in the satisfactory performance of a large maxillofacial prosthesis. Large defects often lack sufficient undercut to allow prostheses to be self-retentive. External modifications of the prosthesis are often required to provide an acceptable result. **Clinical history:** A 10-year-old male presented with a large facial defect and gross scarring following radical ablative surgery in treatment of cancrum oris. The intention of treatment was to restore esthetics to the patient using a removable facial prosthesis until the patient is old enough to receive an implant retained prosthesis. **Methods:** Due to the patient's age and nature of the defect, the prospective size and weight of the prosthesis required the use of mechanical retention that could not be achieved with conventional retentive methodology. An acrylic framework was manufactured as a substructure for the silicon prosthesis. Elastic-retained spectacles were luted via a custom screw-retained chrome-cobalt nose pad. To stabilize the inferior border of the prosthesis, a clear soft thermoplastic polyurethane brassiere strap was threaded through the chin cup and connected to the spectacle strap. This provided the prosthesis with adequate resistance to vertical displacement. **Conclusion:** The patient's appearance was enhanced, enabling early rehabilitation and psychosocial reintegration until a more rigid, implant based prosthesis becomes a viable treatment option. Rapid facial growth is expected over the years to follow and regular maintenance visits will be required.

## Introduction

Trauma, congenital malformation, and ablative surgery may result in large facial defects that cannot be surgically restored. Such defects lead to aesthetic, functional, and phonetic insufficiencies.<sup>1</sup> These are associated with severe psychological strain, often giving rise to alteration in a patient's self-esteem, emotional stability, personality, and social interaction.<sup>2</sup> A facial prosthesis, whether provisional or definitive, therefore enables an environment that is conducive to better function, aesthetics and social reintegration.<sup>3</sup>

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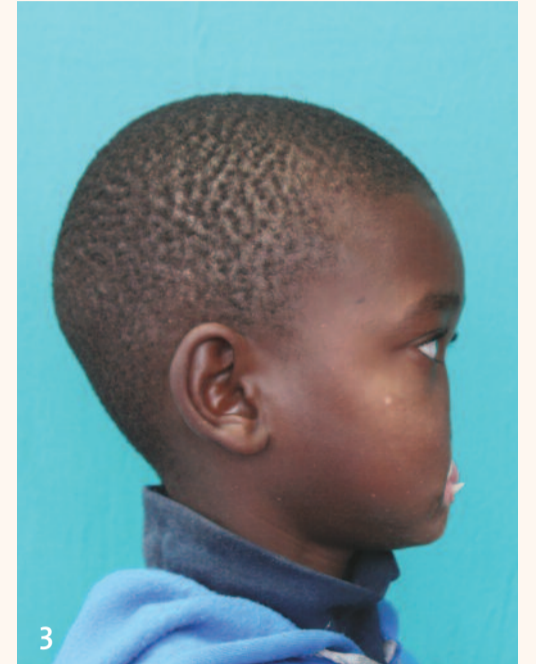
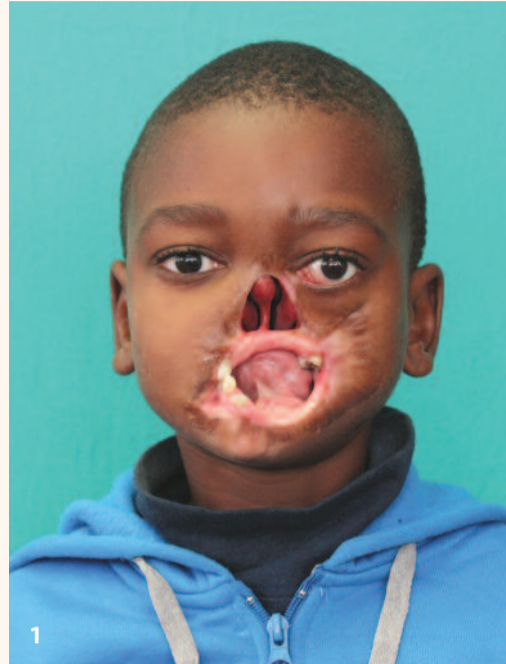


Figure 1: Frontal profile photo of the patient 2 years following treatment of cancrum oris. Note severe facial scarring and the union of external and internal facial structures. Figure 2: Left profile photo depicting severe loss of facial prominence due to loss of the nasal cartilage, premaxilla, anterior mandible and associated labial tissue. Figure 3: Right profile of the patient. Figure 4: Fabrication of an impression-dam to retain the flowable alginate impression material. Note the high-volume evacuator tip retained between the patient's tongue and residual hard palate to act as a breathing apparatus during the impression taking procedure. The nasal aperture has been blocked out with cotton wool. Figure 5: Wax try-in of the sculpted prosthesis.

Rehabilitation of such defects however, presents a unique challenge for the restoring maxillofacial prosthodontist. The typical result is that the inferior base of a prospective prosthesis typically rests on movable tissue.<sup>4</sup> When coupled with the lack of sufficient undercut, the inevitable consequence is the inability of the prosthesis to be self-retentive.<sup>5</sup> Retention is of critical importance in the satisfactory performance of a maxillofacial prosthesis. It aids to enhance aesthetics, comfort, function, adaptation, and the concealing of the prosthesis. Extrinsic retention is typically attained via secondary mechanical factors, skin adhesives and implants (magnets, ball or bar attachments).<sup>6</sup>

The use of adhesives in large facial defects is limited as it may irritate the supporting tissues, may not withstand the prosthesis weight, and causes deliquescence of the adhesive material when exposed to moisture.

Modifications to overcome difficulties are often required to provide an acceptable result. This requires certain innovative methodology as outlined in this article and techniques that can be extrapolated to treatment of patients

with similar defects.

## Clinical report

A 10-year-old male was referred to the post-graduate prosthodontic clinic of the University of Pretoria Oral and Dental Hospital, South Africa, for prosthetic assessment and management. The patient presented with a large facial defect and gross scarring following radical ablative surgery 2 years prior, for the treatment of Cancrum Oris (Noma) (Fig. 1, 2 and 3). Clinical and radiographic evaluations were carried out. Clinical examination revealed that extensive fibrosis was present as a consequence of the resection, resulting in a maximum mouth opening of 1mm. The exposed oral and nasal mucosa were dry and tender to palpation. Despite the gross extent of scarring, the patient was phonetically functional, and was able to compress most foods against his palate using the tongue, as a form of mastication.

A three-dimensional cone beam computerized tomographic evaluation (Planmeca, ProMax3D Max) of the patient revealed a resection of the premaxilla, ranging from tooth 13 to 24, and alveolectomy of the left anterior mandible. Developing tooth buds

were present in the distal segments of both the maxilla and mandible. Limited retained secondary dentition was evident in the anterior segments. The treatment aim was to achieve closure of the defect, and attain concurrent re-establishment of an aesthetic profile.

Attempts at retention of the prosthesis were expected to be challenging; due to the age of the patient, implant retained prostheses were contra-indicated. Furthermore, financial constraints and the expected weight of the prosthesis as a consequence of size precluded the use of dermal adhesives in aiding retention. As an alternative, eyeglass frames have historically proven helpful in providing mechanical retention and concealing prostheses. To improve mechanical stability of a large prosthesis, elastic strips are often placed around the back of the head to join both ends of the eyeglass frames.<sup>3</sup> It was therefore decided to utilize a spectacle-aided retention method with reinforcing elastics to stabilize the superior and inferior aspects of the prosthesis onto the patient's face.

## Treatment sequence

The initial phases of the construction

followed conventional maxillofacial impression protocols. The nasal cavity was packed with cotton wool and lined with petroleum jelly (Vaseline Jelly, Original) to prevent nasal aspiration of the primary impression material. The patient was taught to breathe through a high-volume evacuator tip (Dochem, Evacuator tips, 1A5151 vented "S" white) placed between his palate and tongue, and was further instructed to close his eyes and not make any facial movements during the impression taking procedure. A dam-technique was used to acquire a full facial impression; bands of periphery wax (Kendent, white periphery wax) were linked together and adapted to the border of the intended impression. Pink modelling wax (Zeta, Tenawax) was moulded and attached to this periphery to form the dam walls. Bite registration material (Heraeus, Flexitime) was injected onto the periphery wax to create a seal against the patient's skin and prevent the impression material from leaking beyond the dam as seen in figure 4.

Regular set alginate (Dentsply, Blueprint 20+) was mixed to a high-flow consistency and poured into the dam, and reinforced with pieces of wooden tongue blades (Astra Med,

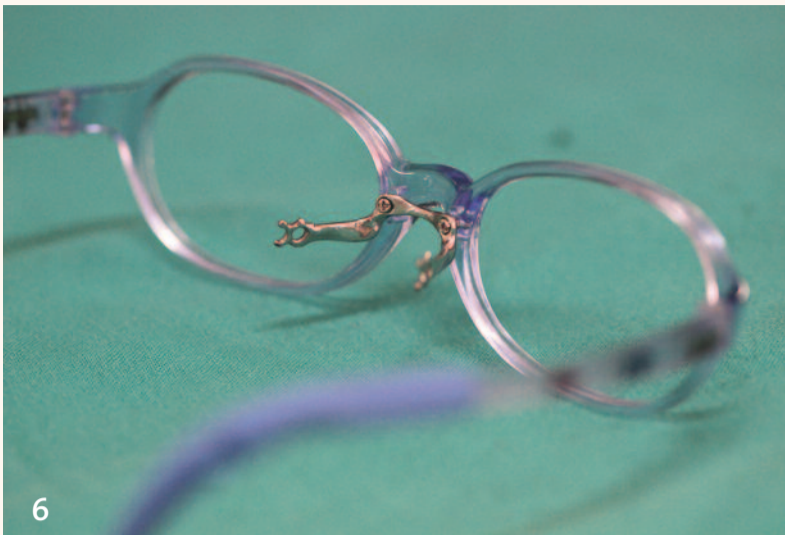


Figure 6: Eyeglass frames (Tomato Glasses, TKAC3) with custom chrome-cobalt nose pad designed to be luted to the acrylic substructure of the prosthesis. Figure 7: Completed facial prosthesis. Note the patent nasal and oral orifices to allow breathing through the prosthesis. Figure 8: Frontal profile of the patient with the facial prosthesis in place. Figure 9: Left lateral profile of the completed prosthesis in situ. The eyeglass frames and brassiere strap link together posterior to the auricle via a discrete hook to provide resistance of the prosthesis to vertical displacement.

tongue depressor) incorporated into the impression material. The primary cast was poured in hard dental stone (Wiegmann Dental, Bondur M yellow), and a light-cured acrylic (Willman and Pein, GmbH Plaque photo) special tray was fabricated based on this impression.

At the secondary impression stage, the patient was again instructed on the procedure and breathing exercises were practiced using the high-volume evacuator tip. Cotton wool was again packed into the nasal cavity to prevent material aspiration and petroleum jelly was used as a separator over structures that could be incorporated into the impression, such as eyebrows and eyelashes. Impressions were taken using a polyether impression material (3M ESPE Impregum Penta) in the custom tray, and a master cast was poured in die stone (Velmix, Whip Mix - Resin rock). The advantage of this technique is that all facial landmarks are present on the casts, which enable the ideal sculpting of prosthetic structures in anatomically correct positions without the need for the patient being present for repeated trials.

A wax try-in was sculpted in pink modelling wax on the master cast in co-ordination with respective facial landmarks. The initial try-in of the wax-up (Fig. 5) was performed where rapid alterations of the facial contours were made using modelling clay

(Staedtler, Noris Club Modelling Clay), which provided good stability while adhering to the wax pattern. The wax try-in was adjusted and a second try-in was performed. A satisfactory marginal fit and suitable aesthetic profile were acquired. The skin shade and tone were determined using a colour chart. As the position of the spectacle frame could only be verified at chair-side, a template of the nasal bridge was created using silicone putty (Zhermack, Zetalabor 85 Shore A). With the template, the correct position of the exposed acrylic spots for luting could be determined, by transferring it to the plaster cast.

A polymethyl methacrylate (PMMA) substructure was constructed in high-impact acrylic (Vertex, Castavaria) to reinforce the silicone and prevent excessive flexure of the prosthesis. As PMMA has limited adherence chemically and mechanically with platinum cured silicones, the substructure was exposed along the prosthetic nasal bridge to allow for the luting process of the spectacles. Acrylic denture teeth (Ivoclar, Ivostar, shade A2, mould 01) were further luted to the substructure to provide a more aesthetic appearance of the facial prosthesis. Once the substructure was complete, processing of the silicone was initiated.

Special care had to be taken not to include any residues of latex (gloves), sulphur (silicone based impression

materials), tin (Impression paste catalyst) or acetate (Cyanoacrylate glue) during the multiple treatment stages. This was done to ensure that no contamination of the silicone had occurred during the curing process.

The size of the prosthesis prevented conventional flasking processes, and custom plaster split-moulds were created. The silicone (Technovent, M511 Platinum cured silicone) of the prosthesis was coloured intrinsically, using polychromatic pigments (Technovent, intrinsic silicone pigment). Following final fabrication of the prosthesis, the spectacle framework (Tomato Glasses, TKAC3) attached to a custom chrome-cobalt nose pad (Fig. 6) was luted to the exposed sub-structure via using cold cure PMMA. Final extrinsic staining (Technovent, extrinsic pigment) was performed and treated with a sealant. The nasal apertures and mouth were perforated in accordance with the acrylic substructure to allow the patient to breathe through the prosthesis.

To prevent movement of the inferior border of the prosthesis, a transparent soft thermoplastic polyurethane brassiere strap (MRP, SKU1702710001001) was threaded through the chin cup anteriorly and connected to the spectacle strap posteriorly, as seen in figures 7 and 8. Adequate retention was achieved and a satisfactory seal was established on the prosthesis boundary (Fig. 8 and 9).

Rapid facial growth is expected over the years to follow and regular maintenance visits will be required. The brassiere straps and spectacle elastics were selected for their adjustable nature and can allow interim alterations between replacements. This is expected to be done at 2-year intervals until the patient is old enough to receive an implant retained prosthesis. Regular follow up will entail exploring improvement of the patient's mouth opening and the further possibility of restoring his dentition and masticatory function.

#### Discussion

Due to the gross amount of extraoral scarring, the patient's mouth opening was limited to 1mm and masticatory efforts were accomplished using pressure of the patient's tongue against his palate. It was deduced that minimal mobility of the extraoral tissue would be present and that a full-facial prosthesis may be constructed to restore aesthetics to the patient. The primary concern during the process of treatment planning however, was retention. Typically, eyeglass frames used in maxillofacial prosthetics rely on the presence of ears and a nose-bridge for support. However, this effect is compromised, and in some cases, negated in patients having undergone surgical removal of either of these anatomical structures.<sup>5</sup> Furthermore, this form of support suspends the prosthesis from the supero-lateral

aspects, providing resistance in the vertical plane from these two points only.<sup>4</sup> In these instances, clinicians consequently make use of adhesives to retain parts of the prosthesis albeit to a less effective result. The weight and span of the prosthesis in this specific patient rendered the use of adhesives inadequate.

Alternative methods or retention were therefore approached until the child is of the age to receive an implant retained prosthesis, as skeletal growth is a less-understood variable when implants are used in children.<sup>7</sup> The procedure described exhibits an effective alternative means of retaining a large facial prosthesis where retention would otherwise be severely compromised.

The incorporation of the brassiere straps effectively reduced movement of the inferior aspect and provided even load distribution along the support structures incorporated into the prosthesis. The tension on the prosthesis can also be attuned via the adjustable straps to maintain close approximation to the tissues as the child grows. In the South African context, a holistic view needs to be taken and factors such as finance, distance to reach treatment centres, and maintenance of prostheses need to be factored into a treatment plan. It is for this reason that a multidisciplinary team approach is needed to ensure appropriate care is given.

#### Conclusion

The crucial role of facial features in daily interpersonal relationships is easily appreciated. In most societies, personal attractiveness plays an integral role in a patient's self-esteem.<sup>2</sup> With a rudimentary extra-oral prosthesis retained by glasses and a facial strap, the patient's appearance was enhanced, enabling early rehabilitation and allowing psychosocial reintegration until a more rigid, implant based prosthesis becomes a viable treatment option.

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# Clinical significance of the anterior loop of the mental nerve: anatomical dissection of a cadaver population

By Muhammad A. Bobat<sup>1</sup> and Ephraim R. Rikhotso<sup>2</sup>

## Abstract

**Purpose:** The anterior loop (AL) of the mental nerve is an anatomical structure that should be considered when placing dental implants in the region of the mental foramen. This study aimed to evaluate the presence and dimensions of the AL using anatomical dissection of cadaver specimens. **Materials and methods:** 20 cadaver specimens were dissected bilaterally yielding 40 sides. The mental foramen was probed before accessing the AL in order to determine the relationship between probing and actual AL length. The AL of the mental nerve was identified and measured through anatomical dissection. **Results:** An AL was found in 22 sides (55%) with a range of 0,52mm to 4,29mm (Mean 1,18mm; SD 1,35mm). Probing versus actual AL length revealed a weak negative correlation between AL length and probe depth. **Conclusions:** The study has shown that clinically significant AL lengths can be present and implant planning must therefore account for these AL.

**Keywords:** Anterior loop; Mental nerve; Dental Implant; Maxillofacial List of Abbreviations

AL Anterior Loop

CBCT Cone Beam Computed Tomography

SCT Spiral Computed Tomography

## Introduction

Dental implant placement in the region of the mental foramen has been known to cause neurosensory deficit due to nerve injury.<sup>1,4</sup> The identification and preservation of the anterior loop (AL) of the mental nerve is an important means of avoiding such neurosensory deficit.<sup>5,7</sup>

There is a general consensus that plain film radiographs are inadequate for the accurate identification of the AL. Bavitz et al<sup>8</sup> compared periapical radiographs to anatomical dissection on 24 cadaveric mandibles. They could not find a reliable relationship between the anatomical dissection and the periapical radiographs in determining the AL length. The radiographic examination revealed AL lengths of 0mm to 7mm while the anatomical dissection revealed AL lengths of 0mm to 1mm. A safety zone of 1mm was proposed to avoid injury to the mental nerve. Mardinger et al, in a similar study on 46 cadaveric hemi-mandibles showed that periapical radiography show false positive presence of an AL in 40% of the sample and failed to identify the AL in 70% of the sample.<sup>9</sup> AL length ranged from 0,5mm to 2,95mm on periapical films and 0,4mm to 2,19mm on anatomical dissection. They proposed a safety zone of 3mm anterior to the mental foramen.

Alternative imaging modalities

such as Spiral Computed Tomography (SCT), as well as Cone Beam Computed Tomography (CBCT), have been used for the identification of the AL. The proposed advantage of these techniques is their ability to create an accurate three-dimensional representation of the structure under investigation, thus eliminating the error of image distortion inherent in plain film radiography.<sup>10</sup> Kaya et al<sup>11</sup> evaluated 73 preoperative patients using panoramic radiographs as well as SCT for each patient. The radiographs and SCTs were evaluated for the presence and length of an AL bilaterally. Results showed that the SCT group identified a higher number of ALs and the mean length of the AL was 3mm versus a mean of 3,71mm for the panoramic radiograph group. Li et al<sup>12</sup> evaluated 68 SCTs of Chinese patients retrospectively and identified an AL in 83,1% of cases. The AL lengths ranged from 0mm to 5,31mm and the authors proposed a 5,5mm zone of safety to be maintained anterior to the mental foramen.

Uchida et al<sup>13</sup> compared CBCT measurements to anatomical dissection and concluded that CBCT confers a high degree of accuracy when assessing the presence of an AL.

Purely anatomical studies have been performed by a few workers. Rosenquist et al<sup>14</sup> evaluated the AL in 58 patients who received inferior alveolar nerve transposition prior to implant surgery. They showed an AL of 0mm to 1mm with a mean of 0,15mm. Benninger et al<sup>15</sup> in a study of 15 cadavers consisting of 30 sides showed the presence of an AL in only 4 sides, all of which did not exceed 1mm in length. They proposed that the large AL lengths previously described in the literature are anatomical aberrations, which are rarely encountered and thus the AL is of no clinical significance. Table 1 highlights the proposed safety zones postulated by various workers.<sup>1,8,9,14</sup>

The aim of our study was to evaluate whether a clinically significant AL does exist using anatomical dissection or whether the structure is of no clinical significance as has been recently asserted.

## Materials and methods

### Population

The study population consisted of cadaver specimens housed by the University of the Witwatersrand Department of Anatomical Sciences.

### Dissection Procedure

The dissection was carried out by the same examiner for all specimens.

The dissection was performed on both sides of each mandible.

Soft tissues were reflected to expose the buccal surface of the mandible in the region of the mental

foramen.

The mental foramen was probed using a Michigan probe, the depth of the infiltration of the probe was recorded. The buccal cortical plate was then removed to expose the inferior alveolar nerve and its branches.

The course of the inferior alveolar nerve was followed and if the nerve looped anterior to the foramen before exiting, this loop length was measured from the most anterior part of the loop to the anterior border of the mental foramen as shown in figure 1.

### Data Collection

Data was recorded on a standard data capture form. Data was recorded for the left and right side of each specimen.

Probing depths: the anterior depth of the mental foramen was probed and measurements were recorded

Anterior loop length: Any AL found was measured using a set of digital vernier calipers.

### Data Analysis

The data was analysed using descriptive statistics and inferential statistics. The variables were grouped into Left and Right groups.

### Study Reliability

All measurements were taken by the same examiner using the same set of instruments.

In order to test intraobserver reliability, repeat measurements were performed on 3 random specimens at the end of the data capture period.

The intraobserver error was noted at less than +/- 5% which was deemed acceptable.

### Ethics

The study is covered by Waiver W-CJ-101109-1 issued by the University of the Witwatersrand school of Anatomical Sciences and as such does not require ethical clearance for health research performed on donated bodies.

### Results

#### Demographics

The study population consisted of 20 specimens whose age ranged from 35 years to 94 years with a median age of 63 years.

#### Probing of mental foramen related to anterior loop length

Probing of the anterior part of the mental foramen yielded lengths ranging from 0mm to 8mm.

A Spearman's rank correlation test was performed which revealed an R-value of -0,0015. This shows a weak negative correlation between probing the mental foramen and the actual AL length.

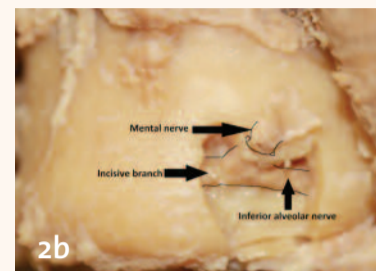
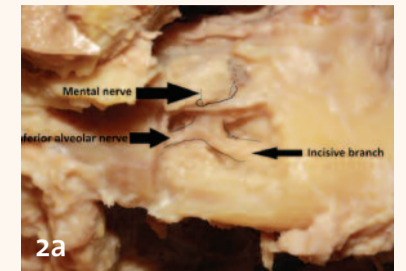
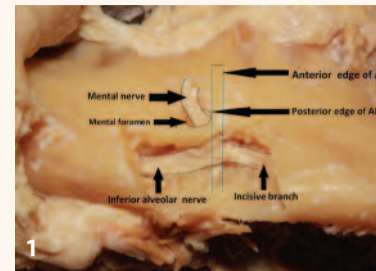


Figure 1: Determination of AL length. Figure 2a shows the morphology of the mental nerve where no AL is present. Figure 2b shows the morphology of the mental nerve where an AL is present – note the branching rather than looping pattern.

Table 1. Proposed zone of safety

Reference	Year	Methodology	Proposed safety zone
Bavitz et al <sup>8</sup>	1993	Anatomical dissection Periapical radiography	1mm
Mardinger et al <sup>9</sup>	2000	Anatomical dissection Panoramic radiography	3mm
Kuzmanovic et al <sup>1</sup>	2003	Anatomical dissection Panoramic radiography	4mm
Li et al <sup>14</sup>	2013	SCT	5,5mm

### Anterior Loop Data

#### Anterior loop frequency

Table 2 shows the frequency of AL found in 40 sides of the dissected specimens. The AL was found in 55% of the sample and absent in the remaining 45%.

#### Anterior loop length

In those specimens where an AL was present, the length ranged from 1,01mm to 4,29mm (Mean 2,12mm; SD 1,00mm) on the right side and 0,52mm to 4,15mm (Mean 2,18mm; SD 1,26mm) on the left side. The combined mean value for all 40 sides was 1,18mm and the SD was 1,35mm.

The descriptive statistics for the AL are reported in Table 3.

A correlation test was performed which showed a 72,01% chance of the AL having a similar length as the contralateral side.

### Discussion

#### Probing

In this study we found that probing the mental foramen does not allow for accurate identification of an AL. The lack of correlation between probing the mental foramen and the AL corroborates the findings of a previous study<sup>16</sup>, therefore it is unreliable and not recommended that the presence of an AL be determined at the time of surgery using direct probing. Reasons for this might include perforation of the medullary bone with the instrument tip, or the instrument tip inadvertently entering the incisive canal when there is no AL present.

#### Anterior Loop

In this study, the AL was found in 55% of the sample and the length ranged from 0,52mm to 4,29mm (Mean 1,18mm; SD 1,35mm), however AL of 4mm or greater was found in 3 sides. There was a 72,01% chance that the AL on the contralateral side would be of equal length. An interesting observation was that the morphology of the AL was not a loop. The AL branched off the inferior alveolar nerve acutely and did not curve or loop as it passed toward the mental foramen. This is similar to the finding reported by Benninger et al<sup>15</sup> and

perhaps indicates that the term 'anterior loop' is a misnomer since the actual morphology of this structure is a branch rather than a loop. Examples of this pattern are shown in Figure 2.

The AL range found in this study is contrary to those reported by Benninger et al<sup>15</sup> who found only 4 AL in 26 sides, all of which did not exceed 1mm in length. Even though there were no loops as large as those previously reported by Uchida et al<sup>13</sup> (9mm) the presence of loops greater than 4mm are significant and could have an impact on implant placement anterior to the mental foramen.

### Conclusion

This study suggests that a weak negative correlation between probing the mental foramen and the actual AL length exist. Also, it appears that an observance of a 5mm safety zone (unless confirmed otherwise by 3D imaging such as CBCTs) or shorter implants are a safer option when it comes to implant placement anterior to the mental foramen. Further studies comparing anatomical dissection and CBCTs may give more clarity on the dimensions and clinical significance of the AL of the mental nerve.

### References

A full list of references is available on request from the Publisher.

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Table 2. Frequency of AL

	Right	Left
No AL	9	9
AL present	11	11

Table 3. Anterior loop length

	Right	Left
Minimum	1,01mm	0,52mm
Maximum	4,29mm	4,15mm
Mean	2,12mm	2,18mm
SD	1,00mm	1,26mm

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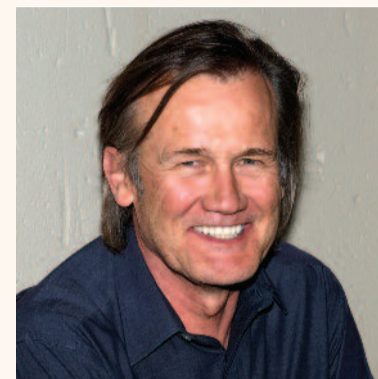
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