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DENTAL PRACTICE

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Bimaxillary fixed total rehabilitation supported by implants following ablation of the maxilla using the All-on-4 Extra-Maxilla concept

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ABSTRACT

Rehabilitation with implant-fixed prosthesis in patients with extreme bone resorption in atrophic jaws with insufficient bone height and width is challenging. Noma, also known as cancrum oris or gangrenous stomatitis, is an infectious disease that destroys the tissues of the orofacial region and is associated with high rates of morbidity and mortality. This article describes a clinical scenario entailing bimaxillary implant-supported fixed rehabilitation in a woman with resected jaws due to cancrum oris using the All-on-4 concept. The patient was successfully rehabilitated and after 4 years, the implants remained functional and free of complications. This clinical report demonstrates that even in an extreme situation, rehabilitation based on the All-on-4 concept is a viable treatment option for a patient that otherwise would not be deemed suitable for rehabilitation with implant-supported prostheses.

Key words: Adult; Dental prosthesis, implant-supported; Maxilla

Introduction

The rehabilitation with implant-fixed prosthesis in cases of extreme bone resorption in atrophic jaws with insufficient bone height and bone width is a challenge [1,2].

The All-on-4 Standard rehabilitation concept uses four implants to support fixed total rehabilitation, with the anterior implants placed in an axial position and the posterior ones tilted up to 45 degrees. This reduces the need for bone grafting, allows anchoring in denser bone (the anterior jaw region) to enable use of longer implants and decrease the size of the prosthetic cantilever [3,4].

The All-on-4 Extra-Maxilla concept was developed for the total rehabilitation of the upper jaw [4] and involves implants with an extra-long design, inserted externally into the maxilla, anchored only by zygomatic bone, and covered by soft tissue [1,5-7]. This surgical technique is an alternative treatment for the rehabilitation of atrophic jaws, and has a high success rate [1,8]. Both All-on-4 Standard and All-on-4 Extra-Maxilla concepts aim at a fixed rehabilitation supported by implants with immediate esthetics and function, with high success rates (99% for Extra-Maxilla [1]; 98% for All-on-4 Standard maxilla [3]; and 98% for All-on-4 Standard mandible [4]). Noma, also known as cancrum oris or gangrenous stomatitis, is

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an infectious disease that destroys the tissues of the orofacial region and is associated with high rates of morbidity and mortality [9-13]. The condition begins as an ulcer on the oral mucosa, usually appearing after measles, malaria and/or necrotizing ulcerative gingivitis, and rapidly progresses to severe tissue necrosis [9-11,13]. Risk factors for this condition are: poverty, malnutrition, low levels of oral hygiene, poor sanitation, infectious diseases, as well as immunodeficiency resulting from one or more of these risk factors [9-13].

This disease mainly affects children (80% were aged <10 years) particularly in developing countries, and especially in the poorest (sub-Saharan) areas of Africa [9]. The global annual incidence is about 140,000 cases, and if untreated, the associated mortality exceeds 90% [14]. Patients who survive noma endure facial disfigurement, intense scarring, trismus, oral incompetence, and social alienation [15].

Active disease warrants antibiotic therapy followed by reconstructive surgery, but these modes of treatment remain inaccessible for the many present-day victims because of their extreme poverty [14]. Its prevention depends on improved nutrition [16].

Herein, we described a completely bimaxillary edentulous woman, who had remained in that state for 11 years after being diagnosed with noma and underwent total resection of the maxilla and partial resection of the mandible, based on the All-on-4 Extra-Maxilla and All-on-4 Standard concepts.

Case report

A 33-year-old Caucasian woman consulted our clinic in December 2006 with a view to fixing her teeth, restoring masticatory function, and improving her facial esthetics. She reported having had noma in 1995, for which she had undergone total resection of the maxilla and partial resection of the mandible. Since that time the patient had been subjected to various jaw reconstructive surgeries, including unsuccessful bone grafting from the iliac crest and had remained unrehabilitated.

Clinically she was deemed to be immunodeficient and smoked 10 cigarettes per day. A thorough clinical examination included photographs, impressions (Orthoprint alginate; Zhermack SpA, Badia Polesine, Italy) and esthetic evaluation (vertical dimension using the Thompson's method, lip support, smile line, and interarch relation). This was followed by imaging (orthopantomography and computed axial tomography) and 3-dimensional bone reconstruction (Fig 1).

The proposed treatment plan entailed total rehabilitation of the upper jaw with the All-on-4 Extra-Maxilla technique, and total rehabilitation of the lower jaw with the All-on-4 Standard technique, all to be performed under general anesthesia. The surgical procedure in the upper jaw began with a mucoperiosteal incision performed along the crest of the ridge, slightly palatal (in each quadrant) from the region corresponding to a second molar to the canine. She also had relieving incisions in the mesial and distal aspects to access the corresponding zygomatic bone. Full-thickness flap reflection using a zygomatic retractor (Hu-Friedy, Leimen, Germany) exposed the inferior edge of the zygomatic bone and the insertion of the masseter fascia in the zygomatic arch (distal limit). The implant was prepared using a round bur as posterior as possible on both sides, so

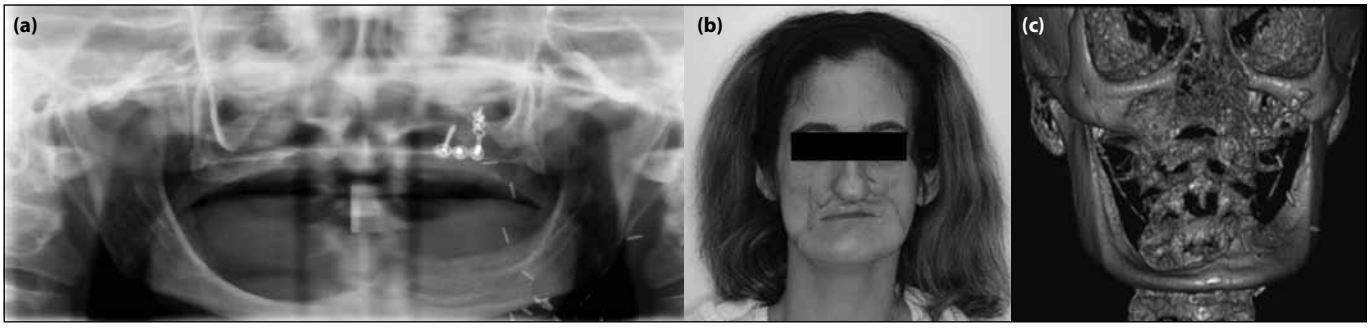

Figure 1 **(a)** Preoperative orthopantomography; **(b)** extraoral preoperative photograph; and **(c)** 3-dimentional reconstruction—initial clinical situation of the patient

as to reduce the cantilever to a minimum. This was followed by the use of a 2.9-mm drill (Nobel Biocare AB, Gothenburg, Sweden), a depth indicator to verify the correct length of the implant, and drills of 3.5 mm, 4.0 mm, and 4.4 mm (Nobel Biocare AB) used sequentially. During preparation, the soft tissues were reflected so as to be protected, with particular attention being paid to the base of orbit to prevent damage to its contents.

In the region of the first quadrant, two zygomatic implants (Nobel Speedy; Nobel Biocare AB) measuring 5 mm in diameter and 40 mm in length were placed with an insertion torque of >50 N. In the region of the second quadrant, two zygomatic implants (Nobel Speedy) measuring 5 mm in diameter and 30 mm in length were placed with an insertion torque of >50 N. The implants featured an angulation of the implant head (25°), external connection, anodically oxidized surface (TiUnite; Nobel Biocare AB), no threads in the coronal third of the implant, and a narrow tip with engaging threads extending to the apex. The implants were inserted using the extramaxillary surgical protocol with exclusively zygomatic anchorage (the maxillary bone was not used for implant anchorage) [1]. To compensate for the slope of the implants, 30°/5-mm angulated abutments were used (Multi-Unit Abutment; Nobel Biocare AB) with a torque tightened at 30 N (Fig 2). The flap was repositioned and sutured (4-0 silk; B. Braun Medical Lda, Barcarena, Portugal). The surgical procedure in the lower jaw began with a mucoperiosteal incision along the crest of the ridge, from the molar to molar region of the third and fourth quadrants. A mucoperiosteal flap reflection was performed identifying both mental foramina. The surgical preparation started with an osteotomy in the mandibular midline using a round bur, followed with a 2-mm drill (Nobel Biocare AB) for the placement of the edentulous guide (Nobel Biocare AB). After identifying the mental nerve on both sides, a round bur was used, followed by the sequential use of 2.0-mm, 2.4- to 2.8-mm, and 3.2- to 3.6-mm drills (Nobel Biocare AB), all with an inclination of 45 degrees. This was to prepare for placement of posterior implants, while for the anterior implants, the same sequence was followed but parallel to the guide pin (Nobel Biocare AB).

Four implants were placed: two in the posterior region of the third and fourth quadrants, tilted distally 45° (NobelSpeedy Groovy RP 4 x 10 mm; Nobel Biocare AB) at the level of the left and right second premolars, and two straight implants in the anterior region (NobelSpeedy Groovy RP 4 x 8.5 mm and 4 x 10 mm; Nobel Biocare AB) at the level of the right and left lateral incisors, with all implant insertion torques of >50 N. Angulated abutments (30°/4-mm Multi-Unit Abutment) were connected to the posterior implants, while for the anterior implants, 2-mm straight abutments (Multi-Unit Abutment) were adapted (Fig 3). The flap was repositioned and sutured with single sutures (4-0 silk). Thereafter, open tray impression copings (Nobel Biocare AB) were placed and connected with a metal bar (Remanium Edgewise Wire, 0.55 x 0.70 mm; Dentaurum, Germany) and acrylic resin (Pattern Resin LS; GC America Inc., Alsip [IL], USA), and the impression made with condensation silicone

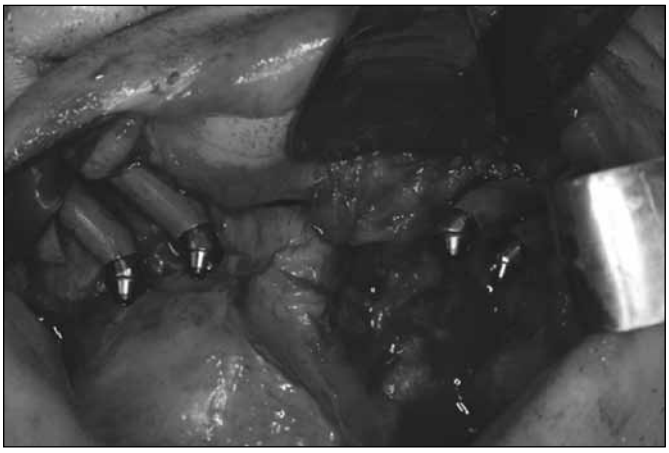

Figure 2 Intraoral preoperative photograph of the maxilla after placement of zygomatic implants

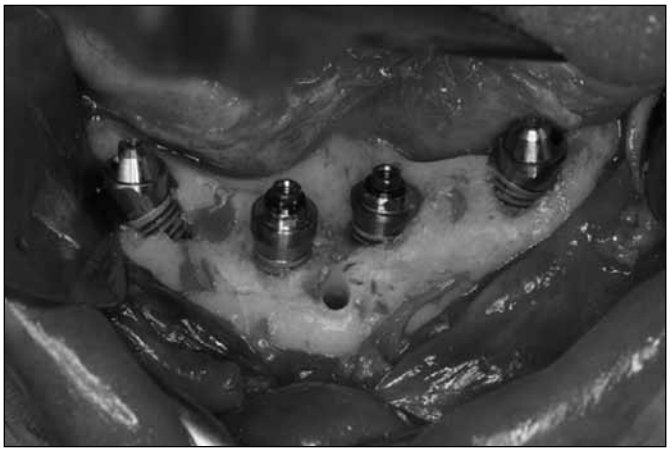

Figure 3 Intraoral preoperative photograph of the mandible after placement of the implants

putty (Elite HD+Putty Soft Fast; Zhermack SpA, Badia Polesine, Italy) in a customized acrylic tray.

Plaster models (OCTA-Rock; Heraeus Kulzer GmbH, Hanau, Germany) with soft tissue were made and a block of wax was stabilized with acrylic (Megatray; Megadenta DentalProdukte GmbH, Radeberg, Germany) to be attached to the anterior abutments. All the esthetic requirements needed (lip support, anterior height of the block, prosthetic occlusal plane, esthetic lines) were taken through this block; a record of the maxillo-mandibular relationship in centric relation in the required vertical dimension of occlusion was also obtained. The crowns chosen were Premium T4 (Heraeus Kulzer GmbH, Hanau, Germany) in the color A2.

The plaster models were mounted on an articulator and proceeded to an assembly of teeth in Class I and later a try-in of the teeth was performed. A few hours into the day of surgery, provisional all–acrylic resin prostheses were connected to the maxilla and mandible rehabilitations (PalaXpress Ultra; Heraeus Kulzer GmbH) with their necessary occlusal adjustment. On this day it was found that implants placed in the second quadrant were very deep in relation to soft tissues and the fixed bridge in place. In turn, this led to the design of custom components (to prolong implant lives) to be manufactured by Nobel Biocare. Amoxicillin/clavulanate 875/125 mg (Labesfal, Field Besteiros, Portugal) were administered every 8 hours during the first 4 days and 12-hourly till day 8 post-surgery; prednisone was also administered: 15 mg on the day of surgery, 10 mg in the next 2 days, and 5 mg on days 3 and 4 post-surgery. Anti-inflammatory medication consisting of ibuprofen was prescribed as 600 mg every 12 hours on days 4 to 8 post-surgery. For additional analgesia, clonixine 300 mg daily was administered as required, for the first 3 days post-surgery. Use of these medications was supplemented by oral hygiene instructions, along with application of hyaluronic acid gel during the first 2 months after surgery, and 0.2% chlorhexidine gel from the second to the sixth month post-surgery. This was in accordance with the maintenance protocol for the functioning implants [1,17].

On day 12 post-operation, the patient was seen in the follow-up clinic for removal of sutures; the wound was noted to be healing well. On the same day the custom components in TiUnite were placed and connected to the abutments of both implants in the second quadrant (to a torque of 30 N). Thereafter relining was fitted to the upper acrylic prosthesis, which constituted the end of the first stage of the patient's bimaxillary rehabilitation with implant-supported fixed prostheses (Fig 4). A system for patient follow-up at 2, 4 and 6 months post-surgery was established, and during this period the patient was submitted to several planned reconstructive facial plastic surgeries. This was to enable the manufacture of new acrylic provisional prostheses with increased lip support and superior qualities for both chewing and esthetics. At month 6 post-surgery, manufacture of the definitive upper and lower dentures

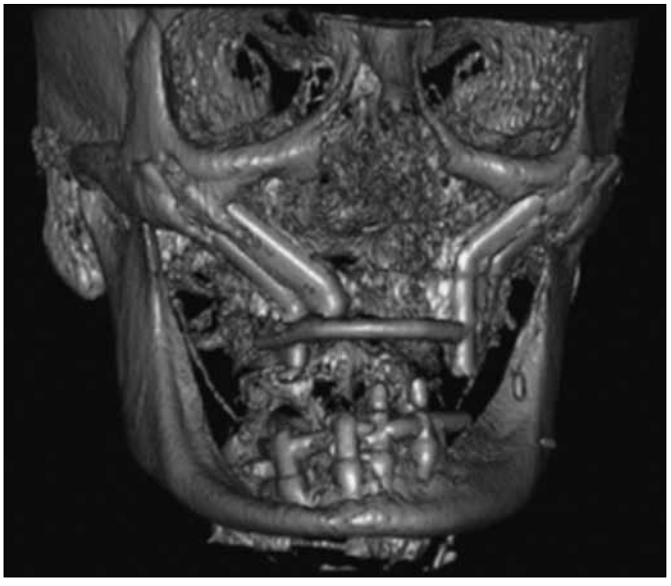

Figure 4 Three-dimensional reconstruction after connection of the implant-supported fixed rehabilitation

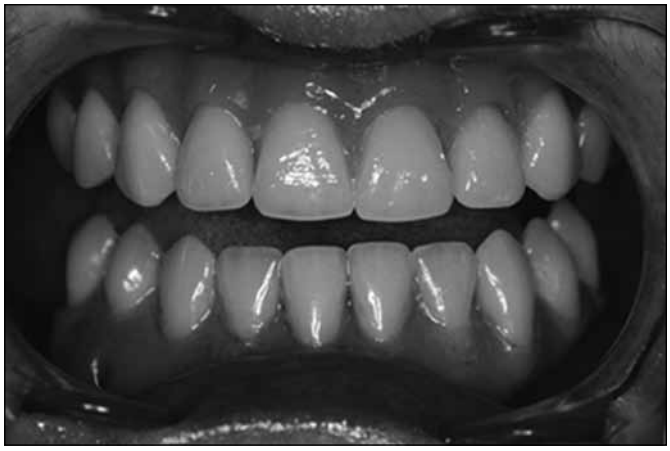

Figure 5 Extraoral photograph with acrylic resin bridge in the upper and lower jaws

(from acrylic reinforced with metal in both arches) was initiated (Fig 5). The patient was followed up at periodic intervals of 4 months for up to 4 years (Fig 6).

The primary outcome was prosthesis and implant survival, survival being judged in terms of function. The prosthesis was considered a failure if it needed to be replaced by any alternative device. In the present case, the prosthesis has remained functional at all follow-ups to date.

An implant was classified as surviving if: (1) it fulfilled its purported function as a support for reconstruction; (2) it was stable when individually and manually tested; (3) there was no evidence of infection; (4) it demonstrated good esthetics; and (5) it allowed fabrication of the implant-supported fixed prosthesis facilitating comfort and hygiene. All implants fulfilled these survival criteria during the 4-year follow-ups.

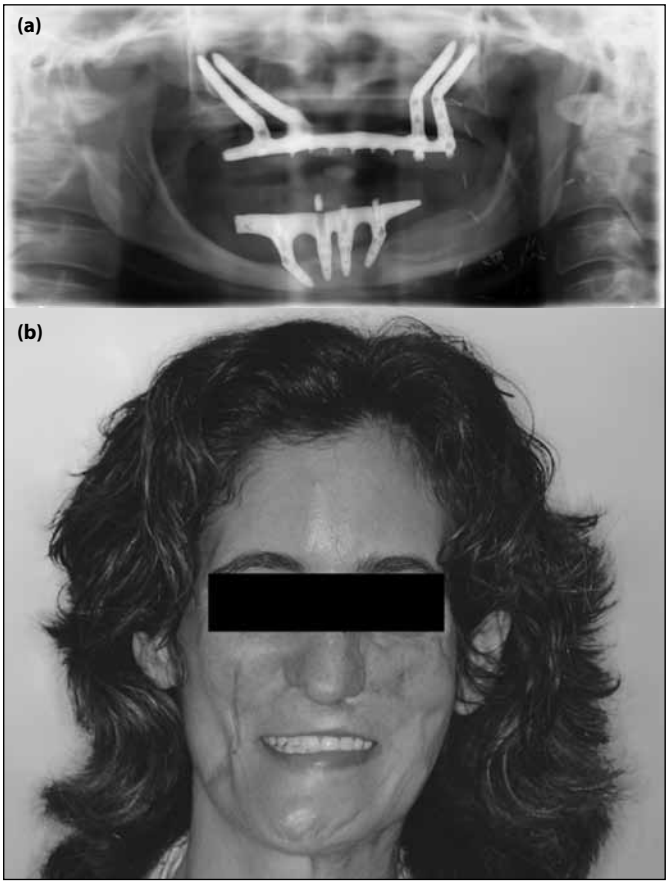

Figure 6 **(a)** Orthopantomography with 4 years of follow-up. **(b)** Photograph after 4 years of follow-up with the patient exhibiting the final rehabilitation

Secondary outcomes were freedom from mechanical and biological complications. This entailed assessments for fracture or loosening of mechanical and prosthetic components (mechanical complications); soft tissue inflammation, fistula formation, maxillary sinus infections and associated pain or discomfort (biological complications); esthetic complaints by the patient or dentist (esthetic complications); and phonetic, masticatory, or hygienic complaints (functional complications). None of these complications were encountered during follow-up to date.

Discussion

As demonstrated in this case, extreme bone resorption in atrophic jaws with insufficient bone height and width constitutes a real challenge for implant-fixed rehabilitation [1,2].

Our patient had endured a bimaxillary edentulousness and had been unrehabilitated for 11 years, following maxillofacial surgery to resect both jaws. Our case demonstrates that rehabilitation with the All-on-4 Extra-Maxilla and All-on-4 Standard techniques can provide a viable option even in extreme edentulism. Both concepts of rehabilitation have several advantages over other therapeutic strategies, namely bone transplants. Most notably they were predictability, simplicity, a high success rate, patient comfort, and esthetics, which were all and achieved through use of provisional low-cost prostheses [1,3,4]. In the upper jaw, the advantage of applying the All-on-4 Extra-Maxilla over other techniques lies in the high rates of successful rehabilitation it can achieve, in contrast to bone grafting (from iliac crests) to reconstruct the jaw. Using extra-long implants placed externally anchored into the maxilla and zygomatic bone allowed overcoming the anatomical limitations posed, thus opening a new approach to using fixed implant-supported rehabilitation in extreme situations [1,8]. For our patient, rehabilitation through a zygomatic implant protocol would not have been feasible, as the patient had no maxillary bone (only fibrous tissue). In the zygomatic implant protocol, the implants are anchored in both the maxillary and zygomatic bones, while for the All-on-4 Extra-Maxilla protocol, only zygomatic anchorage is necessary.

In relation to the lower jaw, the literature also

demonstrates the feasibility of rehabilitating edentulous jaws with the All-on-4 Standard technique, which is an alternative to more complex rehabilitation techniques. This is because it reduces the need for bone transplants and allows anchorage in areas of higher bone quality (maxillary anterior region) [3]. The importance of planning for the rehabilitation of bimaxillary edentulous cases with implants must be stressed, whether carried out presurgically (using anamnesis, clinical examination and imaging) or postsurgically (using an appropriate follow-up regimen). Our protocol enabled successful rehabilitation to be maintained during a mid-term follow-up (4 years), which was consistent with a previous publication based on a similar protocol [1].

Conclusion

This case study demonstrates that even in an extreme situation with absence of the upper jaw and partial absence of the lower jaw, the rehabilitation with All-on-4 Standard and All-on-4 Extra-Maxilla is a viable treatment option for a patient not amenable to rehabilitation with implant-supported prostheses.

References

1. Maló P, Nobre Mde A, Lopes I. A new approach to rehabilitate the severely atrophic maxilla using extramaxillary anchored implants in immediate function: a pilot study. J Prosthet Dent 2008;100:354-66.
2. Calandriello R, Tomatis M. Simplified treatment of the atrophic posterior maxilla via immediate/early function and tilted implants: a prospective 1-year clinical study. Clin Implant Dent Relat Res 2005;7 Suppl 1:S1-12.
3. Maló P, Rangert B, Nobre M. All-on-4 immediate-function concept with Brånemark System implants for completely edentulous maxillae: a 1-year retrospective clinical study. Clin Implant Dent Relat Res 2005;7 Suppl 1:S88-94.
4. Maló P, de Araújo Nobre M, Lopes A, Moss SM, Molina GJ. A longitudinal study of the survival of All-on-4 implants in the mandible with up to 10 years of follow-up. J Am Dent Assoc 2011;142:310-20.
5. Al-Nawas B, Wegener J, Bender C, Wagner W. Critical soft tissue parameters of the zygomatic implant. J Clin Periodontol 2004;31:497-500.
6. Becktor JP, Isaksson S, Abrahamsson P, Sennerby L. Evaluation of 31 zygomatic implants and 74 regular dental implants used in 16 patients for prosthetic reconstruction of the atrophic maxilla with cross-arch fixed bridges. Clin Implant Dent Relat Res 2005;7:159-65.
7. Zwahlen RA, Grätz KW, Oechslin CK, Studer SP. Survival rate of zygomatic implants in atrophic or partially resected maxillae prior to functional loading: a retrospective clinical report. Int J Oral Maxillofac Implants 2006;21:413-20.
8. Rigolizzo MB, Camilli JA, Francischone CE, Padovani CR, Brånemark PI. Zygomatic bone: anatomic bases for osseointegrated implant anchorage. Int J Oral Maxillofac Implants 2005;20:441-7.
9. Enwonwu CO, Falkler WA Jr, Phillips RS. Noma (cancrum oris). Lancet 2006;368:147-56.
10. Berthold P. Noma: a forgotten disease. Dent Clin North Am 2003;47:559-74.
11. Regezi JA, Sciubba JJ, Jordan RC. Oral pathology: clinical pathologic correlations. 4th ed. Saunders; 2003.
12. Baratti-Mayer D, Pittet B, Montandon D, et al. Noma: an "infectious" disease of unknown aetiology. Lancet Infect Dis 2003;3:419-31.
13. Enwonwu CO, Falkler WA Jr, Idigbe EO, Savage KO. Noma (cancrum oris): questions and answers. Oral Dis 1999;5:144-9.
14. Marck KW. A history of noma, the "Face of Poverty". Plast Reconstr Surg 2003;111:1702-7.
15. Ogbureke KU, Ogbureke EI. NOMA: a preventable "scourge" of African children. Open Dent J 2010;4:201-6.
16. Challacombe S, Chidzonga M, Glick M, et al. Global oral health inequalities: oral infections-challenges and approaches. Adv Dent Res 2011;23:227-36.
17. De Araújo Nobre M, Cintra N, Maló P. Peri-implant maintenance of immediate function implants: a pilot study comparing hyaluronic acid and chlorhexidine. Int J Dent Hyg 2007;5:87-94.