THE JOURNAL OF PROSTHETIC DENTISTRY

CLINICAL REPORT

Complete mouth rehabilitation with fixed implant-supported restoration for a patient with myasthenia gravis: A clinical report

Abdusalam E. Alrmali, BDS, MFDS RCS, MDS,[a,b] Berna Saglik, DDS, MS,[c] Ibrahim Sherif, BDS,[d] and Hom-Lay Wang, DDS, MS, PhD[e]

ABSTRACT

This clinical report describes a complete mouth fixed implant-supported rehabilitation for a patient with myasthenia gravis. Patients with myasthenia gravis may have impaired manual dexterity from progressive neuromuscular impairment. Muscle weakness and fatigue, reduced denture stability, and the inability to provide maxillary dentures with a peripheral seal have compromised the ability to wear dentures. Therefore, care is needed when providing an implant-supported prosthesis. This clinical report provides step-by-step management of a patient with myasthenia gravis, providing a complete arch implant-supported rehabilitation. (J Prosthet Dent xxxx;xxx:xxx-xxx)

Myasthenia gravis (MG) is an acquired chronic autoimmune disorder characterized clinically by oscillating weakness and fatigue of the skeletal muscles subsequent to the production of autoantibodies that bind to acetylcholine receptors (AChRs).[1-4] This neuromuscular condition represents a significant clinical challenge for oral health care providers during dental management.[2] Routine dental treatment for patients with MG has been reported to be unsafe and even life threatening.[3]

Disease severity may vary considerably among patients; MG is highly individualized according to the age at clinical presentation, underlying cause, and medical and pharmacological considerations.[3,4] Understanding the nature of this condition and the related polypharmacy is essential before providing dental care to avoid complications. The changes in masticatory patterns and other orofacial muscle activities in patients with MG result in poor masticatory performance which can negatively affect quality of life. MG affects removable denture treatment because of poor manual dexterity, which leads to difficulty and frustration during insertion and removal of the dentures.[3] Weijnen et al[5] reported 'jaw claudication' forcing patients to stop and rest during meals because of masseter muscle weakness and increasing patient discomfort.

A fixed prosthesis is often the recommended option for patients with MG, especially for those with complete edentulism.[6-9] An implant-supported prosthesis is a valuable treatment approach for patients with limited or mild neuromuscular involvement.[1,10] This article describes the clinical presentation and prosthetic rehabilitation with fixed implant-supported restorations for a patient diagnosed with MG.

CLINICAL REPORT

A 70-year-old, completely edentulous man diagnosed with MG was seen in a private dental clinic for

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.
Declarations of interest: The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this article.
[a]Graduate student, Department of Periodontics and Oral Medicine, University of Michigan, School of Dentistry, Ann Arbor, Michigan, USA.
[b]Lecturer, Department of Oral Pathology, Oral Medicine and Oral & Maxillofacial Surgery, School of Dentistry, University of Tripoli, Tripoli, Libya.
[c]Clinical Associate Professor, Department of Biologic Materials and Sciences and Prosthodontics, School of Dentistry, University of Michigan, Ann Arbor, Michigan, USA.
[d]Private practice, Tripoli, Libya.
[e]Collegiate Professor and Director of Graduate Periodontics, Department of Periodontics and Oral Medicine, School of Dentistry, University of Michigan, Ann Arbor, Michigan, USA.

implant-supported fixed restorations. He was unhappy with his existing removable complete dentures because of his lack of manual dexterity, and the constant insertion and removal made it hard to wear his removable complete dentures. Despite losing hope of having a fixed treatment for his teeth, he was willing to undergo procedures to improve his facial profile and masticatory function (Fig. 1A, B). The patient had a history of multiple sclerosis (MS) and myotonic dystrophy, diagnosed in 2011. He was admitted to National and Kapodistrian of Athens, Medical School, Department of Neurology in Athens, Greece with bilateral eyelid ptosis, diplopia, head drop, dysphagia, and difficulty with mastication. In December 2013, his MG relapsed with exacerbation of myasthenic symptoms, especially ocular, head drop, deglutition, mastication difficulty, and respiratory involvement. His condition had been stable since 2013 under the treatment of 60 mg pyridostigmine tablets 6 times per day, and 20 mg prednisolone tablets once daily.

Before commencing dental treatment, a medical consultation was completed to plan for dental implant placement in both jaws under local anesthesia. The patient was informed of all necessary treatment procedures, including surgeries and possible complications, and provided informed consent. Because of the medical and pharmacological considerations, preoperative investigations including complete blood count, liver function tests, kidney function tests, coagulation profile, and vitamin D levels were ordered and recorded. The current stage of MG was stable during the treatment period. A radiographic examination including cone beam computed tomography (CBCT) was obtained to evaluate the amount of available bone and determine the need for bone augmentation. The intraoral examination revealed normal mucosa without any presence of infection or suppuration. Hard tissue examination showed good, wide bone ridges without any sharp edges or concavities. The CBCT examination showed sufficient bone volume in both arches, except maxillary posterior regions, which had inadequate bone height because of sinus pneumatization.

A crestal sinus elevation was planned on the maxillary left side to allow 11.5-mm length implants to be placed. In accordance with the clinical examination and CBCT planning, 14 bone level implants with a chemically modified, airborne-particle abraded, and acid-etched surface (Jdental implant; Jdental care) were placed - 8 in the maxilla and 6 in the mandible.

The surgical intervention was performed under 2% lidocaine with 1:100 000 epinephrine local anesthesia, with the patient in a semi-upright position. Separate procedures were scheduled for each jaw, starting in the morning and to allow time for adequate rest, and to avoid overstretching the masticatory muscles. Intraoperative assessments were conducted periodically, and any changes in patient reaction and/or respiratory status were noted.

At the first surgical visit, a mid-crestal maxillary incision was made, and the flap was reflected using a 2-stage approach. Eight implants (Jdental implant; Jdental care) were placed under copious irrigation. In the posterior maxilla, transcrestal sinus floor elevation was performed using burs (Densah burs; Versah) without the need for a mallet during the procedure. Four weeks later, 6 more implants (Jdental implant; Jdental care) were inserted in the mandible. The suturing was done using 5-0 polyglycolic acid. Postoperative care instructions, including antibiotics and pain medications, were provided.

After 4 months, his MG was still under control, and he was in a stable condition. The maxillary and mandibular implants were uncovered, and healing abutments (Jdental; Jdental care) were attached. The definitive prosthetic design consisted of complete arch maxillary and mandibular implant-supported frameworks with a 1-piece cemented prosthesis. To fabricate the definitive cast and replicate the position of the implants in the mouth, the open tray splinted impression technique was used.[11] Open-tray impression transfer copings (Jdental; Jdental care) were hand tightened onto the implants and splinted intraoral with autopolymerizing acrylic resin (GC Pattern Resin; GC Corp) after verifying seating with periapical radiographs. Definitive impressions were made with a custom tray and polyvinyl siloxane impression material

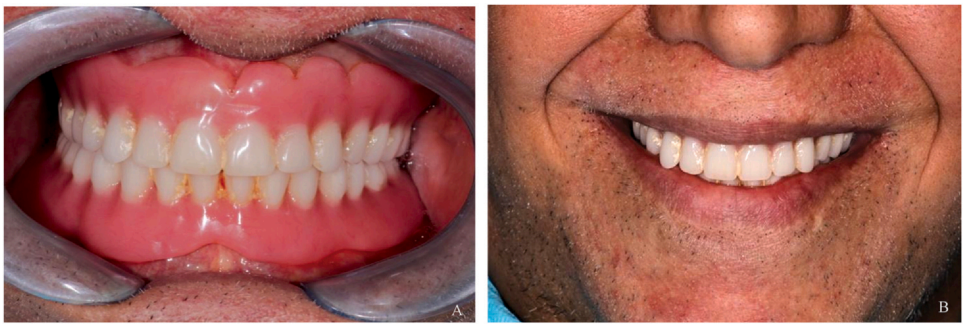

Figure 1. Preoperative clinical presentation with removable dentures in maximal intercuspal position. A, Frontal view. B, Smile view.

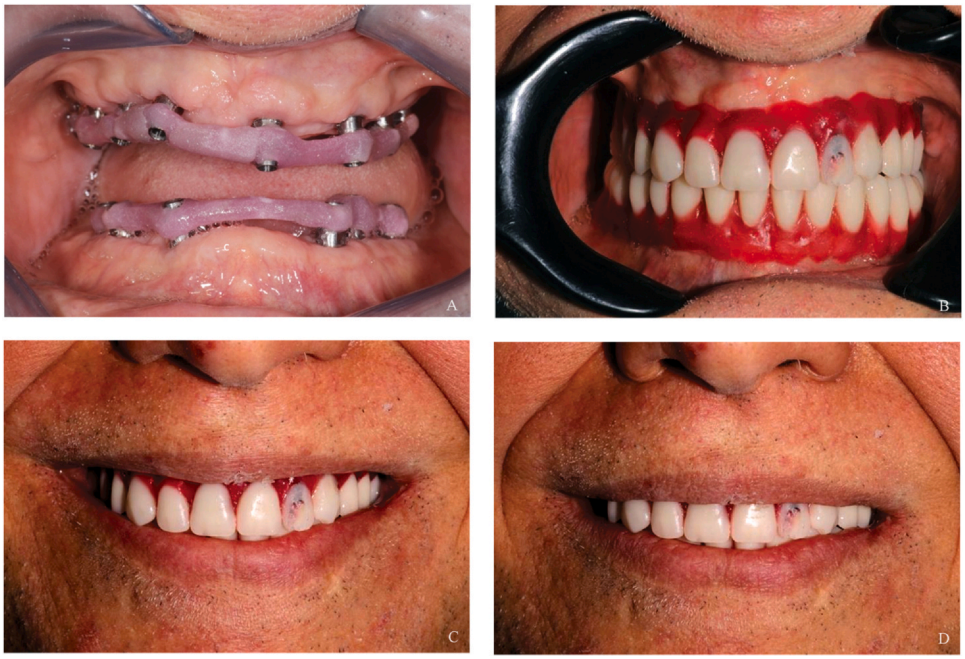

Figure 2. Clinical evaluation using verification device with acrylic resin artificial teeth. A, Verification device used as initial bar to verify insertion of abutments before fabricating definitive bar. B, Maximum intercuspation position. C, Maximum smile view. D, Smile view.

(Identium; Kettenbach GmbH). Nonengaging temporary titanium copings (Jdental implant; Jdental care) were splinted with autopolymerizing acrylic resin (GC Pattern Resin; GC Corp) and used to verify the definitive cast. This verified definitive cast was used to fabricate record bases and wax rims. Esthetics and phonetics were evaluated clinically, and the vertical dimension of occlusion was established. In addition, centric relation and facebow records were made. Definitive casts were mounted on a semi-adjustable articulator (Hanau 190 Modular, Whip Mix Corp). Acrylic resin artificial teeth (Blueline; Ivoclar AG) were attached to the record bases with wax, and the diagnostic tooth arrangement was completed (Fig. 2). Subsequently, the trial denture and the definitive cast were digitized (DCS Scanner, Bredent GmbH) to fabricate maxillary and mandibular definitive bars from biocompatible high-performance polymer (BioHPP, reinforced ceramic PEEK; Bredent GmbH) (Fig. 3). The second part of the prosthesis was fabricated by using 3D prototyping, and a nanocomposite ceramic material (nanocomposite; Predent) was cemented over the definitive bar with a resin cement (Multilink; Ivoclar AG). Maxillary and mandibular fixed implant-supported restorations were delivered with gingiva-colored nanocomposite material (nanocomposite; Predent). The patient's smile, phonetics, and occlusion were reassessed, and adjustments were made at delivery to achieve mutually protected occlusion (Fig. 4).

Professional recall visits were conducted at 6-month intervals, and the patient reported good function and esthetics. At 36 months, radiographic examination revealed

Figure 3. Maxillary and mandibular polyetheretherketone bars.

that all the implants had a stable bone level with no measurable marginal bone loss (Fig. 5). At this time, the patient expressed satisfaction with the outcomes (Fig. 6). However, at the same follow-up, he reported a fracture of the mandibular prosthesis at the distal surface of the right first and second molars (Fig. 7). As a result, a new mandibular fixed implant-supported restoration was fabricated and delivered. In addition, at the 36-month follow-up, color changes at the crown and gingiva of the nanocomposite material were noted.

DISCUSSION

Information on the clinical outcomes of implants in patients with MG is sparse.[10] The present patient had a complex medical history, including ataxia, dysphagia, and poor muscular function associated with fluctuating MG.[2]

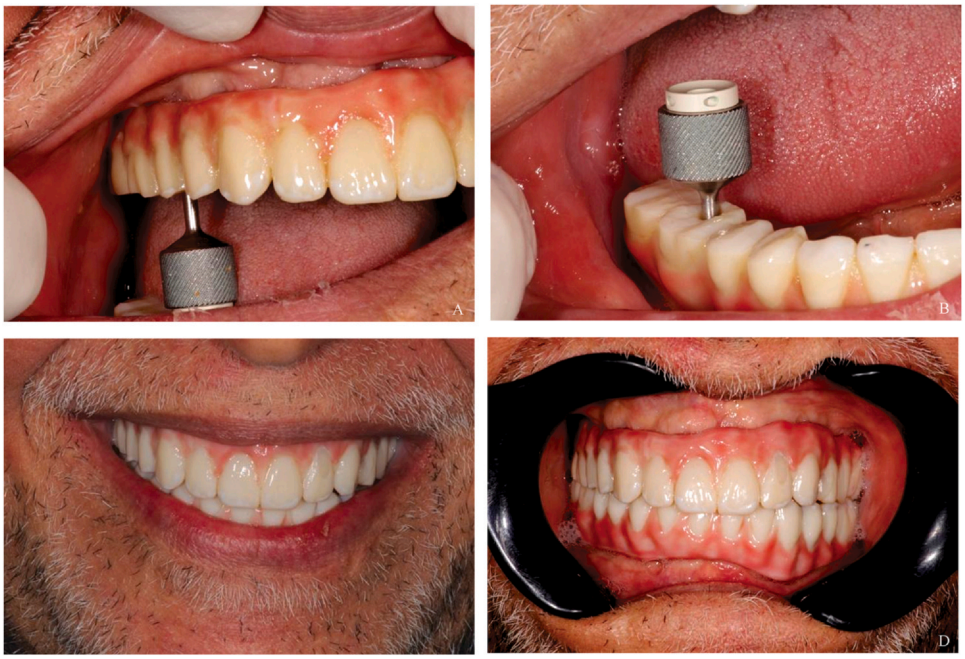

Figure 4. Prosthesis delivery. A, Maxillary fixed implant-supported restoration. B, Mandibular fixed implant-supported restoration. C, Maximum smile view. D, Frontal view in maximum intercuspation position.

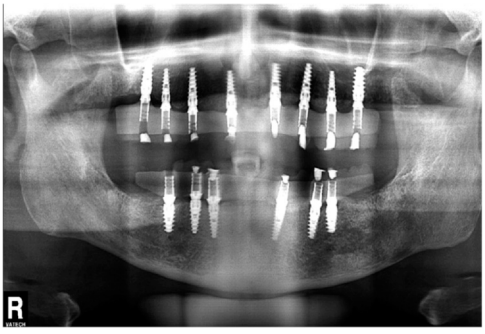

Figure 5. Panoramic radiograph after 36 months.

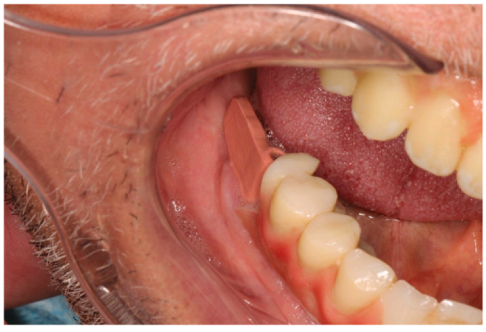

Figure 7. Occlusal fracture of mandibular fixed implant-supported restoration after 36 months.

Removable complete dentures were not a suitable option because of poor retention and the need for constant insertion and removal; therefore, fixed implant-supported restorations were provided.[1,4,8] The acrylic resin teeth of fixed dental prostheses in patients with MG have been reported to fail after around 36 to 48 months.[12] Similarly, fracture of the mandibular right molars was observed in

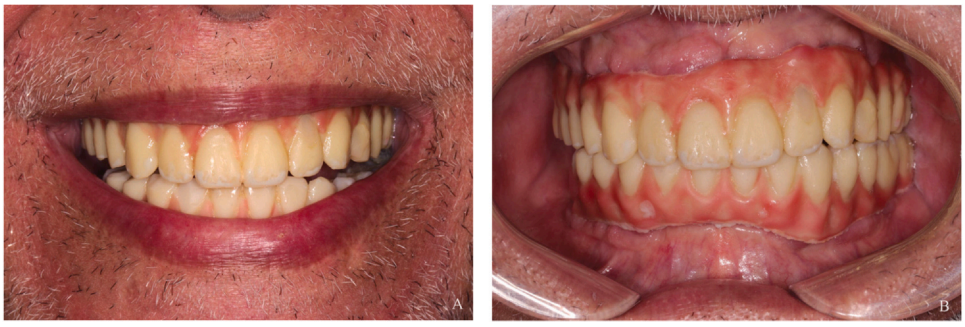

Figure 6. Prostheses after 36 months. A, Smile view. B, Frontal view in maximal intercuspal position.

the present patient after 36 months, although the implants were undamaged and the prosthesis could be retrieved and repaired; however, it did result in additional costs for the patient. Moreover, since patients with MG often exhibit increased occlusal forces and bruxism, materials that are resistant to wear and fracture are necessary. The chipping of the nanocomposite resin in this patient was attributed to his excessive occlusal forces and bruxism.

Sasakura et al[13] monitored changes in occlusal force in a patient with MG and reported that the occlusal force was low when the blood titer of the anti-acetylcholine receptor antibody was high (11.0 nmol/ L, normal < 0.2) but increased after the titer had decreased (1.5 nmol/ L). In addition, implant surgery should be performed in a relaxed and stress-free environment, such as early in the morning.[1,8] While MG is no longer considered a terminal disease, the psychosocial impact of MG should not be overlooked, especially for older patients with emotional challenges.[1,4,8] Depression levels are typically high in patients with MG associated with diminished drug effectiveness over time and severe drug side effects.[1] Hence, psychological treatment, including screening, counseling, and appropriate referral, should be an integral part of the overall treatment plan.

SUMMARY

Despite his complex medical history, dental implants with a fixed implant-supported restoration resulted in a satisfactory solution for this patient with MG.

PATIENT CONSENT

Informed consent was obtained from the patient.

REFERENCES

1. Patil PM, Singh G, Patil SP. Dentistry, and the myasthenia gravis patient: A review of the current state of the art. *Oral Surg Oral Med Oral Pathol Oral Radiol.* 2012;114:e1–e8.
2. Donskov AO, Shimada A, Vinge L, Svensson P, Andersen H. Oral function in patients with myasthenia gravis. *PeerJ.* 2021;29:e11680.
3. Yarom N, Barnea E, Nissan J, Gorsky M. Dental management of patients with myasthenia gravis: A literature review. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod.* 2005;100:158–163.
4. Tamburrini A, Tacconi F, Barlattani A, Mineo TC. An update on myasthenia gravis, challenging disease for the dental profession. *J Oral Sci.* 2015;57:161–168.
5. Jamal BT, Herb K. Perioperative management of patients with myasthenia gravis: Prevention, recognition, and treatment. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod.* 2009;107:612–615.
6. Jacobs R, van Steenberghe D. Masseter muscle fatigue during sustained clenching in subjects with complete dentures, implant-supported prostheses, and natural teeth. *J Prosthet Dent.* 1993;69:305–313.
7. Walsh JC. The diagnosis and management of myasthenia gravis. *Med J Aust.* 1974;1:997–1001.
8. Langer A. Prosthodontic failures in patients with systemic disorders. *J Oral Rehabil.* 1979;6:13–19.
9. Bottomley WK, Terezhalmy GT. Management of patients with myasthenia gravis who require maxillary dentures. *J Prosthet Dent.* 1977;38:609–614.
10. AlHelal A, Jekki R, Richardson PM, Kattadiyil MT. Application of digital technology in the prosthodontic management of a patient with myasthenia gravis: A clinical report. *J Prosthet Dent.* 2016;115:531–536.
11. Gallucci GO, Papaspyridakos P, Ashy LM, Kim GE, Brady NJ, Weber HP. Clinical accuracy outcomes of closed-tray and open-tray implant impression techniques for partially edentulous patients. *Int J Prosthodont.* 2011;24:469–472.
12. Munshi N, Rosenblum M, Jiang S, Flinton R. In vitro wear resistance of nano-hybrid composite denture teeth. *J Prosthodont.* 2017;26:224–229.
13. Sasakura Y, Kumasaka S, Takahashi T, Shindo J. Myasthenia gravis associated with reduced masticatory function. *Int J Oral Maxillofac Surg.* 2000;29:381–383.

Corresponding author:
Dr Hom-Lay Wang, Department of Periodontics and Oral Medicine, School of Dentistry, University of Michigan, 1011 North University Avenue, Ann Arbor, MI 48109.
Email: homlay@umich.edu.

Acknowledgments
The authors thank the technical team, comprised of Dr Abdussalam A. El Jabali and Dr Yousef O. Zendah at Zendah Laboratory (Tripoli, Libya), for their work on this case. The authors also thank Dr Andreas Onisiforou from the Department of Biologic Materials and Sciences and Prosthodontics at the University of Michigan School of Dentistry (Ann Arbor, Michigan, USA) for his contributions in reviewing the article.

CRediT authorship contribution statement
Abdusalam Alrmali: Conceptualization, Investigation, Methodology, Writing - Original Draft. **Berna Saglik**: Writing- Reviewing and Editing, **Ibrahim Sherif**: Resources, Validation, **Hom-Lay Wang**: Supervision, Validation, Writing- Reviewing and Editing.

https://doi.org/10.1016/j.prosdent.2023.05.027