

Digital Fabrication of an Oral Appliance for Assisted Mouth Closure During Sleep for an Amyotrophic Lateral Sclerosis (ALS) Patient

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Introduction

- Amyotrophic Lateral Sclerosis (ALS) patients suffer from a loss of neuromuscular control, and --in this case with bulbar onset-- loss of jaw- head- , and neck muscle control. The deficit in muscle activity made it impossible for the patient to keep the lips closed, resulting in constant drooling. Initially, mouth closure during sleep was maintained with a headgear appliance. However, it was uncomfortable, and an alternate solution had to be found. Here we describe the fabrication process of a pair of intra-oral appliances that could be held together to keep the jaws closed.

Objective

The goal in this case was to utilize digital acquisition and computer assisted design (CAD) to fabricate an intra-oral device for assisted mouth closure for a patient with Amyotrophic lateral sclerosis (ALS) for improved patient comfort without increasing aspiration risk.

Procedure

First Appointment

- Evaluation of the condition of the patient’s dentition (existing undercuts, restorative condition)
- Intraoral scan of maxillary and mandibular arches, with bilateral occlusion scans
- Analog Facebow record

Laboratory Fabrication

- Import scan data into CAD software (ExoCad). Designed bite splints on maxillary and mandibular arches
- Used a scan of a female locator analog as an attachment to plan for the location of the male Locator component
- Printed prostheses in clear biomedical resin (Biomed Clear, FormLabs Dental) and printed intraoral scan models in model resin (Model resin V2, Dental) in a stereolithography (SLA) 3-D Printer (Formlabs Form 3, Formlabs Dental)
- Sectioned and air abraded Locator female analogs (Zest dental), placed into the maxillary appliance and fixated with Triad Gel (Dentsply Sirona)
- Mounted the models on a non-adjustable, arcon articulator. Relieved the mandibular appliance in the sites opposing the upper Locator analogs. Placed Locator male processing caps onto the analogs, closed at the designed vertical, used Triad Gel to “pick-up” processing caps into the mandibular appliance

Second Appointment

- Evaluation of fit (retention and stability) of the prostheses
- Changed the locator male retentive inserts to an appropriate retentive strength
- Evaluation of function:
 - Ability of the patient to close and allow male and female locator components to engage
 - Patient’s upper and lower jaws are kept in a closed position when the patient is at rest
 - Patient able to open and disengage the appliances without complication to allow for external suction of the airway

Outcome

- Prevention of drooling during sleep and sleep quality improvement.
- Ability to easily separate the maxillary and mandibular appliance allowing the caretaker to suction off excess saliva.
- Adjustability of retention force as required to obtain desired resistance to mouth opening by selecting optimal locator inserts.
- Complication: due to minimal height of contour of the patient’s dentition the appliances had to be extended further cervically to assure sufficient retention.

Conclusion

- The described method and prosthesis appears to be a viable option for improving the quality of life of bulbar onset ALS patients regarding mouth closure during sleep. The method of digital acquisition decreases aspiration risk during the records appointment, and the appliance provides an effective and safe alternative to a chin strap appliance for assisted mouth closure. Additional follow-up is required to determine other possible complications

References:

- Kuhnlein et al, Diagnosis and Treatment of Bulbar Symptoms in Amyotrophic Lateral Sclerosis. Nature Clinical Practice Neurology. 2008

