DENTAL TECHNIQUE

Fabrication technique for a custom face mask for the treatment of obstructive sleep apnea

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The positive airway pressure custom mask (TAP-PAP CM) is a treatment option for severe presentations of obstructive sleep apnea (OSA). This custom mask (CM) is fabricated from an impression of the face and is screwed onto the mechanism of the TAP3 (Thornton Anterior Positioner) oral appliance. This continuous positive airway pressure (CPAP) therapy involves a CPAP machine and a hose and face mask for the delivery of positive pressure to stabilize the airway. The mask features a stable and efficient CPAP interface, providing stabilization of the mandible and the airway. The CM has no straps to cause mask dislodgment during sleep movements. In addition, the CM is firmly attached to the cranium through the fit of the TAP element to the maxillary teeth. These design features ensure better compliance and comfort than a stock CPAP mask.1-3 This is the basis for the combination of oral appliance therapy and CPAP therapy (combination therapy).

The TAP-PAP CM was invented4 and developed in 1993 to address the challenges of treating OSA for patients with postpolio complications. These patients have a paralyzed diaphragm or compromised neuromuscular drive, which requires ventilation. Constant volume ventilation is required to adequately maintain the airway and blood oxygen saturation. Average ventilation pressure requires a minimum of 32 cm H₂O with pressures reaching well over 45 cm H₂O (Fig. 1). Standard CPAP masks were not adequate to deal with those pressures (a standard CPAP machine delivers between 5 and 30 cm H₂O pressure). A post was added to the TAP oral appliance (used for the treatment of OSA) in order to anchor a custom-made face mask. A universal joint from facebow technology was used to attach the mask to the post. The result was a perfectly fitting face mask attached to the skull base through the dentition that had no straps and no shifting of the mask. The mandible and airway were stabilized with the TAP aspect of the mask device.5,6 The clinical application for the TAP-PAP CM is for patients on the more severe end of the range of OSA.7-9

ABSTRACT

The development of the positive airway pressure custom mask (TAP-PAP CM) has changed the treatment of obstructive sleep apnea. The TAP-PAP CM is used in continuous positive airway pressure therapy (CPAP) and is fabricated from the impression of the face. This mask is then connected to a post screwed into the mechanism of the TAP3 (Thornton Anterior Positioner) oral appliance. This strapless CPAP face mask features an efficient and stable CPAP interface with mandibular stabilization (Hybrid Therapy). A technique with a 2-stage polyvinyl siloxane face impression is described that offers improvements over the established single-stage face impression. This 2-stage impression technique eliminates problems inherent in the single-stage face impression, including voids, compressed tissue, inadequate borders, and a rushed experience due to the setting time of the single stage. The result is a custom mask with an improved seal to the CPAP device. (J Prosthet Dent 2015; :----)

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Polyvinyl siloxane (PVS) impression technique was developed (Fig. 3). The face impression is critical in the fabrication of this CM, as the seal of this mask is dependent on its accuracy. Presented here is an improved technique for making an accurate face impression.

TECHNIQUE

1. With the patient in the supine position, comfortably fit the maxillary and mandibular dual laminate shells (TAP3) onto the patient’s teeth. With the maxillary shell having a post screwed onto the TAP3 mechanism that protrudes anteriorly through the lips, lute the shells together with thermoplastic material (ThermAcryl) with the mandible set at 3 mm in protrusion (protrusion optional) (Fig. 4).

2. Attach the breathing tube to the post to allow breathing during the impression (Fig. 5).

3. Cut about 10 to 15 mm from a cotton roll, wet it, and insert it into the nose, making sure the nares are well exposed (Fig. 6). Reassure patients at this point that airflow is adequate and encourage them to relax.

4. After rubbing petroleum jelly (Vaseline; Unilever) onto the skin of the face, apply a light-body PVS (3M Paradigm Light Body) with a syringe. Two operators syringing at the same time is preferred (Fig. 7). Cover the bridge of the nose, cheeks, and chin. Cover the lips up to the breathing tubes. Allow the material to polymerize.

5. Take a perforated thermoplastic disk (Airway Management Inc), heat it in a water bath to over 160 degrees, and mold it to the patient’s face (Fig. 8). Cut air holes to allow the breathing tubes to protrude through the disk.

6. Load the disk with a heavy-body PVS (3M Paradigm Heavy Body) from an automatic PVS mixing machine.
(3M Penta), starting expressing the material at the breathing holes of the disk and moving disk in a circular pattern to the borders of the disk (Fig. 9).

7. Move to place the impression disk onto the face while taking caution to insert the breathing tube into the breathing holes of the disk. Then press until the impression squeezes through the perforations on the disk (Fig. 10).

8. After the material has polymerized, remove the impression from the face and the breathing tube from the post. Reinsert the breathing tube into the impression and inspect for any voids (Fig. 11).

9. Remove the cotton and inspect for detail. Look for adequate extension to the bridge of the nose, to the chin, and bilaterally beyond the nasolabial folds. Check for well-defined nasolabial folds and visible border of the nares (Fig. 12).
10. Send the impression to the dental laboratory for the fabrication of the TAP-PAP CM, and on return, insert it onto the post of the luted TAP3 device (Fig. 13).

DISCUSSION

In our experience, these impressions are better than the previous single-stage irreversible hydrocolloid or PVS impressions. Frequent problems with single-stage impressions included voids, compressed tissue, inadequate borders, and a rushed experience due to setting time. On the basis of our extensive experience, irreversible hydrocolloid and PVS face impressions account for about 20% of remakes. These issues are eliminated with this 2-stage technique. Syringing the first stage directly to the face provides control of all these issues.

The efficacy of the CM depends on getting an impression of the face in a relaxed state because this relaxed state best represents the face during sleep. If the muscles are tense during the face impression, then the CM will leak when the patient falls asleep. This technique allows time to apply the material calmly. The patients' facial muscles remain relaxed, and they tolerate the procedure well. This 2-stage face impression technique produces an accurate impression of the face with 1 attempt, resulting in a CM that fits accurately on the first insertion.

SUMMARY

The clinical application for the TAP-PAP CM is for patients on the more severe end of the range of OSA who require combination therapy.7-9 The 2-stage face impression technique for the fabrication of the CM is an improvement on previous techniques. It eliminates the issues of obtaining accurate face impressions that are inherent in the 1-stage impression technique. This 2-stage impression technique not only reduces the time required for the impression and the delivery of the CM but also provides a superior CPAP interface.
REFERENCES


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Acknowledgments
The authors thank W. Keith Thornton, DDS, the inventor of the TAP-PAP CM, who offered his expertise in the development of this technique and guidance in the improvement of this critical CPAP interface.