The Durability of Intraoral Devices for Snoring and Sleep Apnea: Another View

· **Alan A. Lowe,** DMD, Dip. Ortho., PhD, FRCD(C), FACD ·

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Over the last decade, oral appliance use for the treatment of snoring, mild obstructive sleep apnea and for those patients who are intolerant of nasal continuous positive airway pressure has increased significantly. Obstructive sleep apnea is a progressive disease with serious cardiovascular and mortality consequences. The increased mortality is due not only to the progression of cardiovascular disease but also to judgement errors made while driving or operating machinery — a result secondary to the excessive daytime sleepiness commonly seen in these patients. Canadian research has provided a significant amount of new knowledge in the field of obstructive sleep apnea. Recent findings have significantly increased our knowledge of how oral appliances should be used and which appliances are best suited to different patients.[1,2]

Titratable appliances, such as the 2 devices described by Dr. Tyler, allow for incremental advances of the mandible and permit some degree of lateral and vertical jaw movement.[3] Of the 57 oral appliances currently available on the market, 2 commonly used appliances — the Klearway[3,4] and the Silencer[5] — were developed in Canada. Dr. Tyler outlines manufacturing or material defects in these devices for 2 patients fitted with a Klearway and 2 patients fitted with a Silencer. Unfortunately, the author does not provide any indication of the frequency of these breakages as a percentage of his total case load nor any information on how long any of the 4 appliances had been worn in the mouth. It appears that all 4 patients were heavy bruxism subjects, who provide the biggest challenges of all for any intraoral appliance worn at night. Bruxism is extremely common in sleep apnea subjects,[6] is believed to occur at the time of arousals and occurs more often in patients with milder levels of the disease. When sleep architecture improves, the frequency of the bruxism decreases. Clinicians with experience in this field advise patients at the commencement of therapy that these dental appliances last approximately 2 years, on average, and then need to be replaced. A useful analogy is that they are like contact lenses, which similarly wear out or distort over time.

Three types of problems are described in Tyler's report — acrylic tears, wire breakages and pin shears. Acrylic tears can occur anywhere in these appliances, but are most often at the edges of the acrylic trays. Thermoactive acrylic resin is more sensitive to such tears than is hard-cure acrylic, but the significantly improved retention characteristics of the former more than compensate for this inconvenience. Simple tears can be repaired at the chairside with cold-cure acrylic. In my practice, it appears that edge tears are commonly seen in patients who do not rinse their mouths with warm water before removing the appliance in the morning and consequently apply excessive force. Tears at the acrylic–metal interface occur with all intraoral appliances (including those used in orthodontics and prosthodontics), and one should not be surprised that these problems are also seen with sleep apnea appliances. A separation of the wirework from the palatal acrylic is also common in patients who open their mouths wide and then try to remove the lower rim from the mandibular teeth. This action, especially if the appliance is not warmed, places excessive force on the screw–wire interface and results in acrylic fractures and breakages that may be seen when the appliance is being removed or during a subsequent parafunctional activity. If heavy bruxism is suspected by the clinician, the initial prescription should request that additional hard acrylic be added at the time of manufacture to reduce the chance of fracture at this site. Additionally, all patients who wear appliances made of thermoactive acrylic resin should be instructed to rinse the mouth with warm water before attempting to remove the appliance, to keep the jaws lightly together and to remove the lower arch first by pushing upward. After the lower arch is dislodged, the upper rim is removed by pushing downward until the appliance is dislodged and removed from the mouth. These instructions are provided with every Klearway manufactured and were delineated after experience with several hundred patients.

As to breakages at the screw–wire interface, the laser bonds do fail on occasion, and one of the anterior arms can separate from the screw and become loose in the mouth during sleep, when the patient is cleaning the appliance or even when the clinician attempts to adjust the wirework at the screw interface or elsewhere. We do not yet have an ideal metal for any intraoral use, and breakages do occur due to work hardening,

manufacturing defects, patient misuse and many other factors. Other common examples outside the sleep apnea field are sections of orthodontic arch wires that fracture, Adam's clasps that break at the acrylic–wire interface and numerous partial-denture metal and acrylic material failures. Although the author claims that one patient "awoke with a large segment of heavy-duty wire in his pharynx" and later states that the wire was in the patient's throat, it appears more likely that the section of wire was located intraorally and not in the patient's airway or esophagus. By design, the anterior arms of the Klearway are between 33.0 mm and 36.0 mm in length and incredibly difficult to swallow or aspirate. Smaller sections of wire such as those commonly used in fixed or removable orthodontic appliances are more likely to be problematic, but in my experience, such events are incredibly rare. The human airway and gastrointestinal tract are well protected by complex neural sensory protective mechanisms, which are tested in clinical dentistry on a regular basis.

Regardless, such wire breakages as described by Dr. Tyler are very disconcerting to clinicians and to patients. Two options exist at the time of initial appliance design to reduce the chances of such occurrences and can be detailed on the laboratory prescription. One is to instruct the dental laboratory to gold-solder a crossbar between the 2 anterior arms approximately 5.0 mm to 7.0 mm ahead of the screw. This addition has been commonly used by clinicians and manufacturing laboratories. Another option is to place a bend at the end of the anterior wires as they exit the tubes on the lower rim; however, this option prevents further separation of the 2 arches for adjustments, remakes or repairs in the future. The final choice, as with any intraoral appliance, is the clinician's, and needs to be determined at the time the initial prescription is forwarded to the laboratory.

The 2 titanium hinge breakages with the Silencer appliance are probably related to factors similar to those outlined above. The profession must continue to acknowledge that no ideal intraoral metal, screw, pin or plate exists and that breakages can and do occur on a regular basis. The important difference with appliances used for the treatment of snoring and obstructive sleep apnea is that subjects (and their bed partners) become very dependent on these appliances for the relief of daytime sleepiness, morning headaches and myriad other symptoms. Taking an appliance away from a patient results in a recurrence of symptoms and should be done only when absolutely necessary, especially for patients with severe obstructive sleep apnea. Often a temporary "boil and bite" appliance is used while the patient's custom-made appliance is being repaired by the laboratory.

Finally, Dr. Tyler's emphasis that "a regular recall program must be instituted to inspect the device for defects" is well taken. In addition, these appliances need to be examined for effectiveness and advanced if necessary, to be examined for evidence of wear and to be evaluated for compliance.[3] As with any type of intervention, a number of short-term and long-term side effects can occur with an intraoral appliance. Two recent reviews have evaluated these side effects in considerable detail,[7,8] and clinicians who use oral appliances for the treatment of snoring and obstructive sleep apnea should be aware of this information so that they can prepare their patients in advance and initiate suitable preventive procedures when appropriate. ◆

Dr. Lowe is professor and chair, division of orthodontics, department of oral health sciences, faculty of dentistry, University of British Columbia.

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