The MDSA Plus: A construction guide

By Terry Whitty

"From the perspective of a dental laboratory, the MDSA is an ideal appliance to offer to your clients who are interested in the burgeoning area of dental sleep medicine. To produce the MDSA, you simply buy a kit containing all the parts required and then manufacture it using materials and equipment present in most labs..."

Snoring is a noise generated by vibration of the soft, floppy parts at the back of the throat on breathing in during sleep. Habitual snoring can be the first sign of a much more serious condition called Obstructive Sleep Apnoea (OSA).

Snoring and OSA are widespread and can cause significant heath issues. Recent studies infer Habitual Intermittent Snoring has been assessed to affect over 34% of the adult population and OSA over 9% of women and 24% of the adult male population.[1] Often the problem is first noticed by the person's sleeping partner - who notices that in addition to snoring, the sufferer has periods of non-breathing - and they lie awake fearful that breathing may not start again. Unfortunately, snorers do not hear themselves but others do. Snoring has now been directly associated with causing Hypertension (High Blood Pressure) in a statistically significant number of patients.[2]

In contrast to "simple snoring", if the restriction of the airways is a complete blockage to breathing during sleep, then this is called Obstructive Sleep Apnoea. The main problem with OSA is the affect on blood oxygen levels in the body. If we cannot inhale air, oxygen levels are reduced. While we are asleep, the brain senses the lack of oxygen and stimulates the body to wake up (called an arousal). Breathing returns to normal until the next blockage.

In people with severe OSA, these arousals can happen up to 400 times a night. The night's sleep is very disrupted, resulting in excessive daytime sleepiness the next day. Research has now proven that untreated OSA can lead to things such as Daytime Sleepiness, Mood Swings, Workplace Accidents, Motor Vehicle Accidents (20-30% of accidents in Australia in 2001), Reduced Productivity, Impaired Quality of Life, Marital Disharmony and Cardiovascular Disease.[2]

The main treatment advocated for OSA is the Constant Positive Airway Pressure (CPAP) device

Figure 1. A CPAP device.

Figure 2. The MDSA - Medical Dental Sleep Appliance (standard).

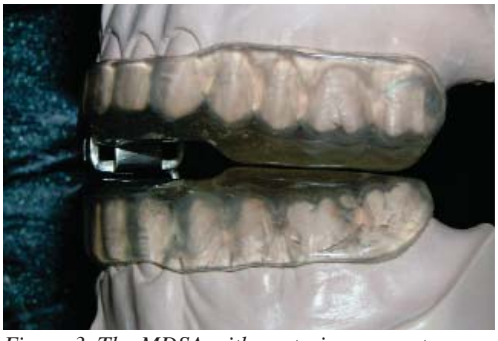

Figure 3. The MDSA with posterior support.

Figure 4. Start with quality casts and block out any major undercuts. I've used wax because I will duplicate with Hydrocolloid. If you are not going to use duplicates you could use high melt wax or composite.

Figure 5. Duplicate models horseshoed ready for pressure forming. Some people like to use lead shot and embed the models in it before pressure forming. Use your favorite technique.

Figure 6. The material of choice Erkoloc Pro 2mm thickness. If you are not going to "shell" the Erkoloc Use a 3mm blank.

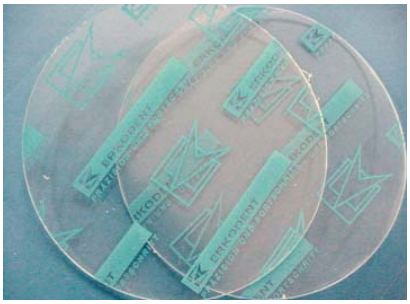

Figure 7. The blanks (foils) have a separating layer. Make sure this is used model side down.

Figure 8. Remember separating layer model side down, so the writing is backwards.

Figure 9. Ready to press, use your machine of choice most are suitable.

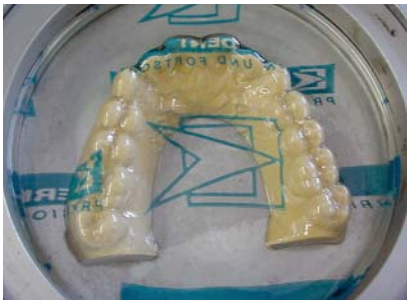

Figure 10. Upper blank pressed.

Figure 11. Lower blank pressed.

Figure 12. Cut excess from around models. Leave a small "handle" anterior so you can hold this when applying acrylic.

Figure 13. Using a blue tinted monomer, add Dentaurum Orthocryl orthodontic acrylic all over the blank to a thickness of approx 2 mm. The blue colour will help the inner urethane layer not to discolour so drastically. If it does discolour somewhat it masks it well.

(Figure 1). CPAP works by maintaining positive airway pressure through the nose to keep the airways open and hence stop the collapse and subsequent blockage. CPAP relies on the interface (mask) to maintain a leak-free seal and the patient to wear the mask all night. However, patient compliance is a major problem.

The other main treatment is by the use of some form of oral appliance. Oral appliances have a similar affect to the airway by moving the jaw and tongue forward and holding it there during the night. These are typically called Mandibular Advancement Splints (MAS). There are over 300 different designs of MAS on the market today and more are regularly introduced as novel news ways of holding the mandible forward are invented. The reality is this that MAS devices have been in use in the orthodontic specialty for nearly 100 years in the form of functional appliances so there is nothing new about holding a mandible forward, just the method has evolved.

The MDSA appliance - an acronym for Medical Dental Sleep Appliance - is a patented Australian-designed MAS. It has a simple design and is quite easy to con-

Figure 14. "Shelling" the blank.

Figure 15. Completed acrylic "shelling".

Figure 16. Place in warm water only under pressure for 20 minutes. You do not want the pressure formed layer to distort.

Figure 17. Shell the lower.

Figure 18. Cure in pressure pot.

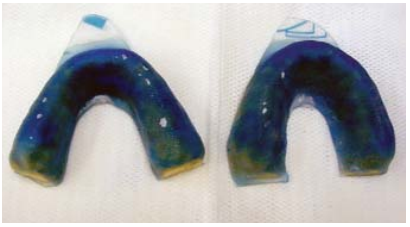

Figure 19. Cured upper and lower.

Figure 20. Component kit of parts for the MDSA.

Figure 21. Close-up of the Screw and the platform.

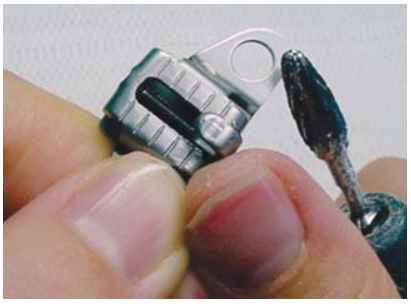

Figure 22. Modifying the shape of the screw component.

Figure 23. It is most important to round this area off otherwise it will irritate the mouth.

Figure 24. Modifying the lower platform.

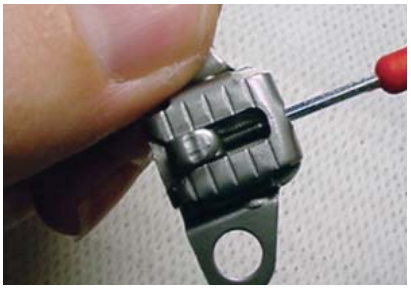

Figure 25. Insert the key to the screw and wind the hook to the middle position.

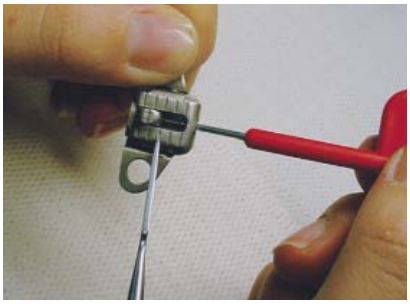

Figure 26. The middle position is pointed out by the tip of the Le Cron.

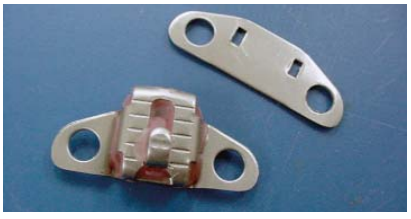

Figure 27. Modified Screw and Platform. Note the wax blocking out the screw. This will save you lots of time later by preventing any acrylic entering the screw, don't be in a hurry - take your time to do this step.

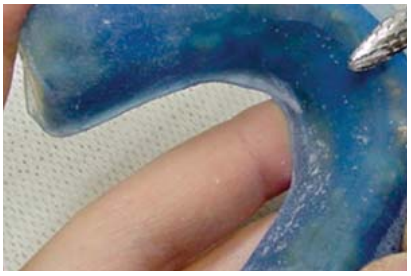

Figure 28. Trim the lower anterior ready to accept the platform. Trim down until you hit the Erkloc material.

Figure 29. Position the platform. The anterior/posterior positioning will have an effect on the maximum protrusion. Consult your practitioner and if they want extra protrusion place the platform more posterior.

Figure 30. Embed the platform with Orthocryl acrylic.

Figure 31. Embedded platform the acrylic was cured under pressure.

Figure 32. Trim lower appliance.

Figure 33. Trimmed lower appliance ready to polish.

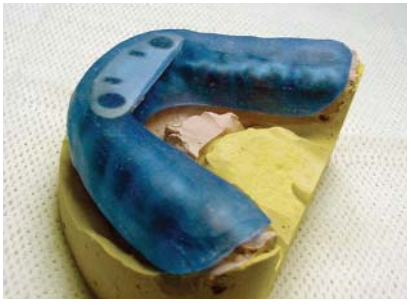

Figure 34. Fit check on model if you have a master, it should be a tight fit.

Figure 35. Trim upper appliance and make room for the anterior screw to fit.

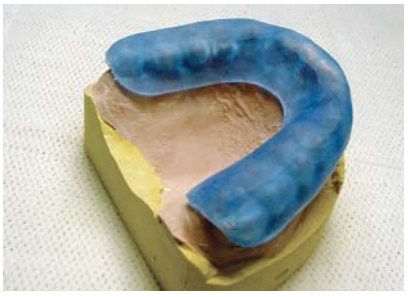

Figure 36. Check fit on model.

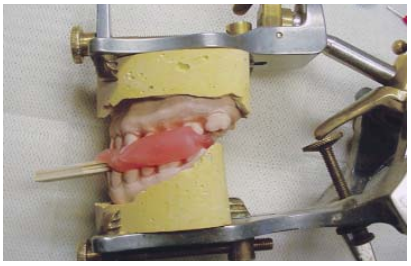

Figure 37. Use construction bite and mount on articulator. I like to use a plaster less, used correctly its quick and accurate.

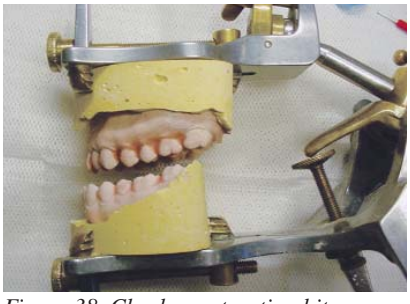

Figure 38. Check construction bite relationship.

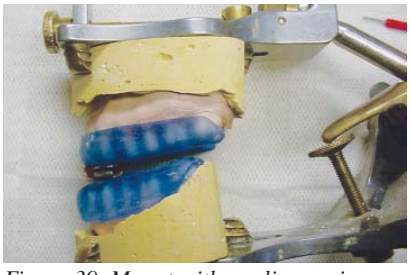

Figure 39. Mount with appliances in place and position upper screw. I am making a standard MDSA Plus i.e. no posterior support.

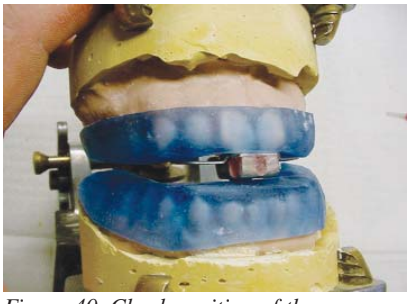

Figure 40. Check position of the anterior screw.

Figure 41. Add acrylic to secure screw. I like to use the salt and pepper method but use your favorite method.

Figure 42. Place in pressure pot and cure. Good idea to use a rubber band around the articulator.

Figure 43. Acrylic cured around upper screw.


Figure 44. Appliance ready to polish.

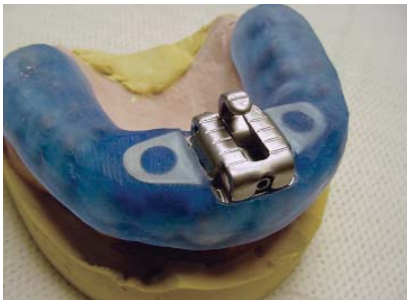
Figure 45. Close-up upper before polish.


Figure 46. Close-up Lower before polish.


Figure 47. Polish upper.

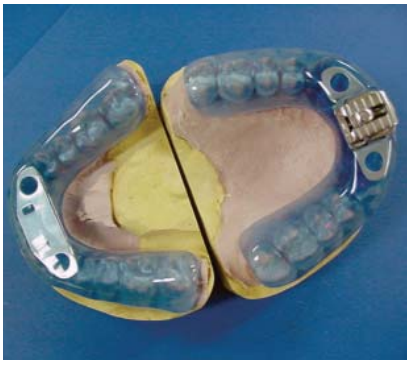
Figure 48. Shiny appliances.

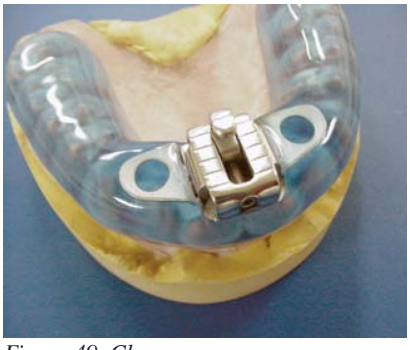
Figure 49. Close-up upper.


Figure 50. Close-up lower.


Figure 51. Anterior view. Where you finish the appliance gingivally will depend on tooth anatomy and presence of desirable undercuts. This case lacks major undercuts so needed to be kept fairly high.

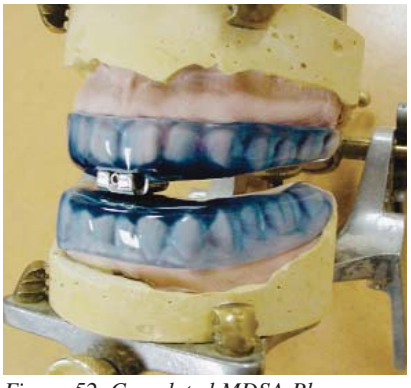
Figure 52. Completed MDSA Plus (Standard).

struct (For more details on the MDSA see www.titratibleappliance.com).

From the perspective of a dental laboratory, the MDSA is an ideal appliance to offer to your clients who are interested in the burgeoning area of dental sleep medicine. To produce the MDSA, you simply buy a kit containing all the parts required (see Figure 20) and then manufacture it using materials and equipment present in most labs.

The original design of the MDSA suffered from severe discolouration of the bi-laminate inner soft material so in an effort to counteract this, I present a method of avoiding this and also making the appliance far more robust and virtually indestructible.

About the MDSA

The Australian made MDSA is in use in 25 countries and in excess of 30,000 patients have been treated. It is patented in Australia and the USA and patent pending in Europe. The MDSA has US FDA 510(k) approval and is registered in Taiwan and Canada. It is exempt from registration with the TGA and CE.

References

1. Am J Respir Crit Care Med Vol 170. pp 656-664, 2004. Originally published in press as DOI: 10.1164/rccm.200311-1571OC on June 16, 2004.
2. Young T, Palta M, Dempsey J, Skatrud J, Weber S, Badr S. The occurrence of sleep-disordered breathing among middle-aged adults. N Engl J Med 1993, 328:1230-1235.

About the author

Terry Whitty is the technical editor of eLABORATE and also runs a successful orthodontic laboratory in Sydney's eastern suburbs where he produces innovative appliances using the latest techniques and technologies including laser welding. He has also lectured throughout Australia and New Zealand on a variety of subjects.