John Viviano DDS D ABDSM I MorePracticalPearls.com

More Practical Pearls

Updated March 2019

OVERVIEW OF SLEEP DISORDERED BREATHING

CAD/CAM APPLIANCES

3D PRINTED NYLON APPLIANCES

D-SAD | X-3 | Narval CC | Oventus | DDSO

MILLED PMMA APPLIANCES

Herbst | Dorsal | Micro2 | OptiSleep

V 3.03

More Practical Pearls

Prepared by

John Viviano DDS D ABDSM

> Knowing is not enough; we must apply.
> Willing is not enough; we must do.
> - Goethe

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Compliant with American Academy of Sleep Medicine Guidelines

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Introduction

My first Practical Pearls eBook spoke of a “New World” way of viewing appliances that manage Sleep Disordered Breathing (SDB); the CAD/CAM 3D printer way. This manufacturing process involves a 3D printer that uses laser sintering of type 12 polyamide nylon, in successive layers, creating the appliance from the inside out.

There have been a number of changes since these appliances first appeared in North America; ResMed has exited the North American market leaving us with no more Narval CC, and ongoing warrantee obligations for Narval CC appliances we have delivered. Panthera has evolved their D-SAD appliance based on end-user feedback requests, and has also developed a new 3-in-One appliance, the X-3 which will be introduced in the coming months. There have also been two new appliances introduced, both pending FDA approval and US availability, the Oventus, and the DDSO. The DDSO is currently available in Canada and the Oventus is soon to be available in Canada.

These devices are made of a Type 12 Polyamide Nylon that is tasteless, has no reported allergic reactions, is lightweight, sleek, and minimally imposing on tongue space. They allow for isolation of a particular (weak) tooth from being used for retention, and the lost retention can be mathematically distributed to the remaining teeth so as to maintain the original retention. These appliances are unlike anything we have used in Dentistry to date. Compared to traditionally hand-made acrylic oral appliances they seem flimsy and unsubstantial. However, real-life experience with them has demonstrated that the Nylon material they are made of is much more durable than the acrylic we have been accustomed to using in Dentistry. We can thank 3-D printers for the new-found ability to use Nylon to fabricate oral appliances.

From a patient experience point of view, these appliances have surprised both me, and others. They come with 3-5 year warrantees and although Nylon is not repairable, these warrantees help to provide the clinician and patient piece of mind. After several years experience, it is clear that Nylon appliances typically outlast their warrantee.

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Introduction *cont'd*

This nylon polymer has a very unique set of characteristics; rigid at a thickness of 2 mm or more and flexible at a thickness of 1 mm or less, it can be safely reduced to a thickness of 0.5 mm and down to 0.2 mm for a small surface area such as a cusp tip, without compromising appliance integrity. It is even possible to pierce through the material over a very small area without affecting the structural integrity of the device, but an uninformed patient may interpret this hole as a defect so this is best avoided or if necessary explained to the patient before performing the adjustment. This nylon polymer is quite remarkable to say the least.

It is worthwhile becoming familiar with these appliances and their unique characteristics. Consider this eBook a venue for sharing information on how to best utilize Nylon oral appliances, providing practical tips and advice for those considering becoming acquainted, or in the midst of becoming acquainted with these unique appliances. End user feedback is always welcome and will be included in future updates of this manual. As I have stated before, we are all going up this learning curve together. As always, I welcome case studies involving the use of Nylon appliances for inclusion in the next update of this eBook. Of course, all case studies will cite the clinician that submitted the work. Please forward case studies including pictures to me via email; **john@drviviano.com**.

We have recently added **Milled Acrylic CADCAM appliances** to this eBook. Please also consider sharing your clinical experiences with these acrylic appliances for future versions of this eBook.

This field is changing rapidly, in this eBook, we will discuss the current status of Acrylic Milled and Nylon 3D printed Oral appliances that manage Sleep Disordered Breathing. In order to stay current with the inevitable evolution of these appliances, we will be updating this eBook regularly. So **always ensure that you are referring to the most current version of the More Practical Pearls eBook.**

More Practical Pearls

This eBook is About Real Clinicians Sharing Real Clinical Experiences

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Chapter 1

LinkedIn Discussion Group SleepDisordersDentistry

A couple of years ago I formed the ***"SleepDisordersDentistry" LinkedIn*** discussion group to be used as a venue for ***wet-fingered practicing clinicians and adjunctive individuals to discuss Snoring and Sleep Apnea Oral Appliances and adjunctive therapies.*** This forum, intended to foster communication and collaboration for all that treat breathing-related sleep disorders with an oral appliance, provides **a venue to share and learn from each others daily clinical experiences.** To date we have had numerous heated discussions covering many controversial topics. The discussions have been posted on my LinkedIn profile in the form of Consensus Articles. I thank those that have participated and hope to keep this venue going for many years so that we may have continued sharing of our knowledge and experience.

To date, we have almost 700 members, I like to think of this Linkedin Group as a 24/7 Sleep Rounds, where those of us that do this on a daily basis can share our experiences regarding ***different appliances, appliance design options, appliance selection, calibration methodologies, bite taking methodologies, managing side effects, evaluating bruxism with Home Sleep Screeners, discussion about various Home Sleep Screeners, dealing with vertical, combining oral appliance therapy with other treatment modalities such as position, CPAP, weight loss, surgery etc.***

Together, we can all be better clinicians than we are alone. Please consider *Joining this discussion group today and let's continue on this path of discovery together. With conversations happening 24/7, you should be able to have questions answered by other clinicians that have already dealt with the same issue you are currently challenged with.*

Go to LinkedIn and look up LinkedIn Group "SleepDisordersDentistry", then click on "Join". Post articles, case presentations, start a discussion, ask questions etc.

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Chapter 2

Nylon Appliances: Inception to Date

Circa 2012, the ResMed Narval CC and the Panthera D-SAD, both appliances of similar design, entered the North American Market. Their history prior to this date may be controversial but has now become simply irrelevant. However, what is relevant is that 6 years later the ResMed Narval CC is no longer distributed in North America and the Panthera D-SAD now holds the exclusive spot for this particular appliance design. We are including details on the Narval CC in this eBook for the benefit of those Clinicians that still have access to it.

ResMed's abrupt exit from the North American market is deserving of some discussion. As usual, when one is trying to understand why decisions like this are made, the surest answer revolves around the old adage, "Follow the Money". After investing a great deal of time, resources and money trying to have the official Medicare definition of an Oral Appliance modified to include newer appliances such as the Narval CC and falling short, ResMed decided to pull the Narval CC from their line-up because without Medicare insurance coverage, they could never be in a position to produce enough appliances to satisfy their Share-Holders expectations. However, the Narval continues to be available in Europe where they have established insurance coverage for this type of appliance, so, exiting this market was a financial decision and not related to the worthiness of the Narval, or Nylon appliances in general.

For those of us that have delivered many hundreds of Narval's over the last 6 years. ResMed will honour their 3-year warrantee, but will be asking the patient to sign a Release once the Warrantee is engaged. So, they get one remake. Personally, I am surprised that ResMed would put any restrictions on their warrantee, but not quite as surprised as I am about the several week waiting period for any remakes. They have shut down their North American facility and all Warrantee work will be done in Lyon France. Thankfully, Nylon appliances don't break very often!

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Chapter 2

Nylon Appliances: Inception to Date

Since 2012 we have seen these two original appliances evolve with many new design features, a testament to the benefits of working in a CAD/CAM environment. Panthera in particular has demonstrated a very keen interest in responding to end users requests and has invested a great deal of resources into creating a better Nylon Appliance. Along with their flagship D-SAD appliance, they are very close to announcing a second Nylon appliance call the X3 that is actually a 3-in-One appliance.

We are now beginning to witness new and different Nylon appliances entering this arena; the Oventus and the DDSO are exciting new appliances that will be available very shortly in the US, pending FDA Approval, and will likely be available as of the completion of this eBook in Canada. Considering the benefits of working with Nylon, I fully expect the number of different Nylon appliances to increase in the coming years.

As Nylon appliances are a work in progress, so is this eBook, so please ensure that you are reading the most current version of this publication, always downloadable Free from our website; SleepDisordersDentistry.com.

Panthera
D-SAD

Panthera
X-3

ResMed
Narval CC

Oventus

DDSO

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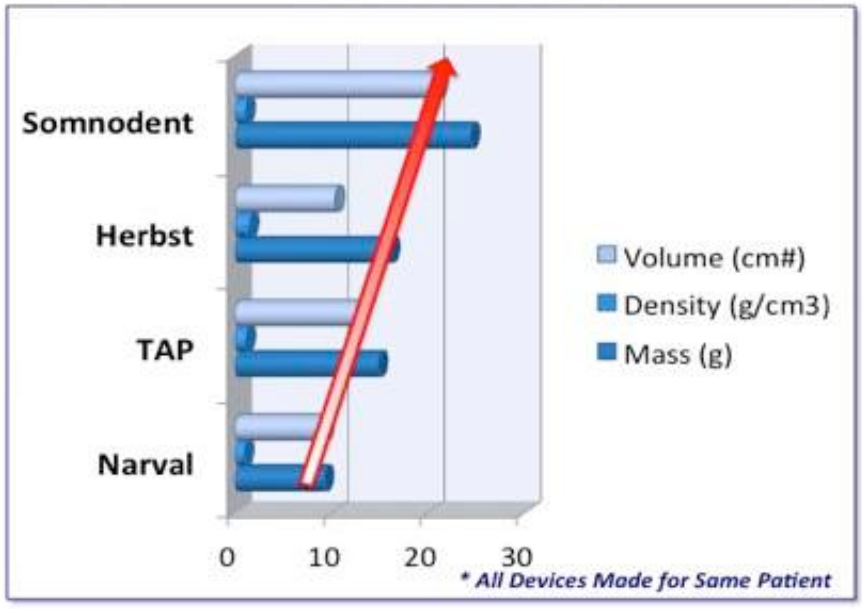
Chapter 3

Benefits of Nylon Oral Appliance: Size and Weight

In a direct comparison study of 4 popular Sleep Apnea appliances the Narval by RESMED was found to be notably smaller and lighter than the other appliances. The four appliances compared were all made to fit the same patient. The Narval was found to have a weight that was 162% less than the Somnodent and a volume that was 126% less than the Somnodent. I can tell you from clinical experience that these differences are the first thing patient's note when transitioning from an "Old World" acrylic appliance to a "New World" Nylon appliance. Of course***, since the footprint does not vary much between the Nylon Appliances, this benefit exists for all the Nylon appliances discussed in this eBook***



- *Source: Centre Technique des Industries Mécaniques*
  Technical Center for Mechanical Industry

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Chapter 3

Benefits of Nylon Oral Appliance: Size and Weight

Clinical Experience: Size and Weight General Observations

As we all know, these appliances have a life span. At this point in my practice a good portion of the appliances I fabricate are replacing existing appliances that are at the end of their lifespan. Almost without exception, I find that these patients when shown a "New World" nylon appliance opt for them as their replacement appliance, mostly because of the small size and "Spa Like" appearance. The types of comments I hear when first inserting or at the first adjustment appointment for their new nylon appliance includes,

"This appliance is so much easier to wear than my old appliance"
"I can close my mouth easier"
"It doesn't feel as much of a mouthful"
"It's much more comfortable"
"I am wearing it all night rather than taking it out at 4 or 5 in the morning" **and** ***"I'm sleeping much better"***

Perhaps size doesn't matter…

Unless you're talking about furniture

Or you have to put it in your mouth!

More Practical Pearls

Chapter 3

Benefits of Nylon Oral Appliance: Size and Weight

Clinical Experience: Size and Weight Case Study

I once fashioned a Herbst appliance for a patient that had many crowns that he was thinking of replacing in the future, but was not ready to act on. He had a very severe level of apnea and could not tolerate CPAP at all, even after trying several masks, this patient wanted a Nylon appliance because of its small size but we decided to proceed with an appliance that would be more forgiving when adjusting around future crowns, even allowing for a full reline if necessary; the Herbst.

Unfortunately, at the insert appointment, the patient could not tolerate wearing the Herbst at all. He had difficulty obtaining lip closure and felt that it was too much of a mouthful. I sent it back to the lab to see if they could reduce the vertical and bulk of acrylic and re-inserted it. The patient took it home and returned the very next day, begging me to make him a Nylon appliance, an appliance we decided against due to the crown work he was planning for the future. Seeing the distress in his eyes, I agreed.

Upon delivery of the Nylon appliance, he was very pleased and after a couple of adjustment appointments we established through a sleep study that his very severe apnea had been resolved.

More Practical Pearls

Chapter 3

Benefits of Nylon Oral Appliance: Size and Weight

Clinical Experience: Size and Weight Case Study *cont'd*

What makes this case interesting is the size of his appliances. This gentleman has a VERY large dentition. Quite frankly, I have never seen a dentition of this size and in fact, this was the very first time I had such an experience with a Herbst. In the photo's you will find the Patient's Narval and Herbst along with the standard Nylon and Herbst samples that I show patients at consults. Note the remarkable difference in size!

Typically, we think about these Nylon appliances being suitable for very petite individuals that would logically have difficulty tolerating a bulky acrylic appliance, but in addition, I think this case provides good support for the use of a Nylon appliance for very large dentitions where the size of the final acrylic device would be so large as to reduce patient adherence to therapy.

Sample Acrylic Appliance - Patient Acrylic Appliance

Sample Nylon Appliance - Patient Nylon Appliance

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Chapter 4

Benefits of Nylon Oral Appliance: Durability

Type 12 Polyamide Nylon

A semi-crystalline polyamide known as Nylon 12, this Nylon has physical properties that make it excellent for manufacturing many different products. It is mainly used for films for packing material in the food industry and sterilized films and bags for use in the pharmaceutical and medical fields. When added to polyethylene films, it improves water vapor permeability and aroma impermeability. It is also prepared as sheets and sintered powder for coating metals. In the electronics field, it is used for covering cables and as insulating material, while in the automobile industry it is used to prepare oil and gasoline resistant tubes. In the cosmetic and personal care industries it is used as bulking and opacifying agents in face and body powders and has also found uses in the textile industry and for producing sporting and leisure goods among other applications.

Nylon 12 has a lower concentration of amides (nitrogen-containing organic compounds) than any other commercially available polyamide and it's characteristics make it beneficial in the following ways:

- ***Absorbs very little moisture providing a high degree of dimensional stability, even in a moist mouth***
- ***Retains excellent impact & non-impact strength, even at below freezing temperatures***
- ***Excellent resistance to chemicals***
- ***Exceptionally strong resistance to cracking under stress, including when used to encapsulate components (such as teeth)***
- ***Excellent resistance to abrasion***
- ***Very low coefficient of friction when dry run against other materials (like buccal mucosa)***
- ***Dampens noise and vibration***
- ***Incredibly fatigue resistant, even when placed under high-frequency cyclical load***
- ***Highly Processable.***

Wolfgang et al. "Nylon-12-Preparation, Properties, and Applications" Ind. Eng. Chem., 1970, vol. 62, pp 16–22
Kubisa et al. (1985). *Cationic Ring-Opening Polymerization.* Advances in Polymer Science. 68/69. Springer Berlin Heidelberg. p. 201-208
Mark, James E. (1999). *Polymer Data Handbook.* Oxford University Press, Inc.

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Chapter 4

Benefits of Nylon Oral Appliance: Durability

Clinical Experience: Durability Case Study

The best way for me to explain the durability of type 12, polyamide nylon is to share a clinical story with you. Many of us have experienced the patient that presents with a Sleep Apnea appliance that has been chewed up by their pet dog. Unfortunately, when this happens, most often the appliance is damaged beyond repair and requires a replacement. Of course this imposes not only an expense to the patient but also, a period of time with no appliance as the patient awaits the manufacturing and delivery of their replacement appliance.

One afternoon a patient presented in my office with his two appliances. An Acrylic appliance made by another dentist in January 2014, and a Nylon appliance, that I had made for him in June of 2014. This 62-year-old high-level executive was first diagnosed with OSA 12 years ago and was finally directed towards an Oral Appliance after years of CPAP difficulties and non-compliance. The reason he had two appliances is that he originally presented in June with a small fracture in his 6 month old Acrylic appliance and was interested in an alternative that may be more durable. After showing him a Nylon appliance he decided to proceed with it and have his Acrylic repaired to use as a back up appliance.

This is where it gets interesting. The patient took both his appliances out of their case and explained that ***they had been chewed by his Afghan Wolfhound named Luke.*** Now, I'm sure Luke had no idea that he was about to become a celebrity dog. However, much like Mickey Mantle and Rocky Marciano did with the Timex watches, Luke put these two appliances to a "torture test" demonstrating their durability, resiliency and shock resistance.

Benefits of Nylon Oral Appliance: Durability

Clinical Experience: Durability Case Study *cont'd*

The Acrylic appliance was damaged beyond reasonable repair and ended up in the trash. However, the Nylon appliance, regardless of the chew marks that were clearly evident, simply required some minor cleaning away of undermined nylon with an acrylic bur, some disinfection and then went back in the mouth. The patient was comfortable and claimed he did not notice any changes as to fit or feel with the appliance as compared to prior to the incident.

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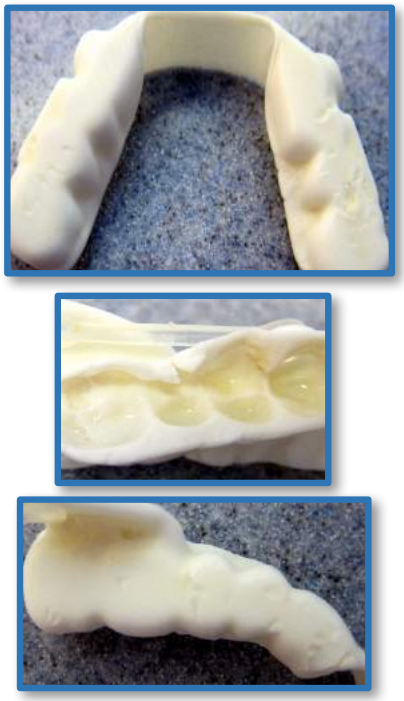
Chapter 4

Benefits of Nylon Oral Appliance: Durability

Clinical Experience: Durability Case Study *cont'd*



The next day I called the patient to ask how things went. He said, ***"my wife is happy, no snoring and I had a restful nights sleep. The appliance was as comfortable as before."*** Luke has helped to demonstrate that a Nylon appliance literally…

"Takes a Licking and Keeps on Ticking!"

More Practical Pearls

Chapter 5

Advancment Straps
The Fuse Concept

Advancement Straps

Although 3D printed nylon appliances such as the ***Narval CC by ResMed*** and ***D-SAD by Panthera*** have demonstrated themselves to be extremely robust, it turns out that they do have an ***"Achilles Heel"; the advancement strap***. Even though this only applies to those patients that adequately challenge their appliance through extreme bruxism, it would be prudent, to have a plan in place to manage this issue.

Let's start by understanding the ***"raison d'etre".*** The easiest way to explain this is by comparing the advancement strap to an ***electrical fuse***. Patented in 1880 by Thomas Edison, a fuse ***protects from catastrophic surges of electricity***. By placing a 'Fuse" between the electrical source and the electronic circuitry, the integrity of the circuitry is preserved in the event of an electrical surge, protecting from catastrophic events such as damage to Hard Drives, Mother Boards, Circuit Boards etc.

In the oral cavity, ***"extreme bruxism events" can be likened to these "electrical surges".*** According to the Oxford Handbook of Applied Dental Sciences *(2002),* maximum biting forces generate around 110 to 160 lbs/sf. Typically, for bruxers that sufficiently challenge their appliances, catastrophic events such as appliance breakage is common. In 3D printed nylon appliances, the advancement straps actually act as a "Fuse". When these straps stretch or fail, they ***protect from more serious "Catastrophic" events such as breakage of the appliance body, restorative work or teeth, and straining of the periodontium, musculature or Temporo-mandibular Joint.***

Fuse Effect: When Strap fails and disengages from body of appliance rather than body of appliance failing.

More Practical Pearls

Chapter 5

Advancment Straps
The Fuse Concept

Advancement Straps *cont'd*

When the ***D-SAD*** first arrived, it came with a much beefier strap than the Narval CC. Which at first appeared to be an enhancement, until they demonstrated to be problematic ***with heavy bruxers; the attachment nubs (Figure 3) simply distorted***, which allowed the advancement strap to pull through the engagement hole. At this point the strap required replacement. The solution was simple. Panthera created a ***"b"*** version of their straps that had ***beefier nubs, meant to stand up to the forces anticipated in these heavy bruxing situations.*** When I inquired as to why all the straps were not made beefier I was told that making the straps beefier reduces mobility and thus patient comfort, so it is better to use the beefier nub only when indicated. This made sense to me and all was fine until the same patient had the same problem with his new ***"b"*** strap. That is when I was told that ***for very extreme bruxers they have an even beefier strap referred to as a "B" strap.*** Interestingly, to date, the patients I have transitioned to either a ***"b"*** or ***"B"*** strap have ***not reported any reduction in comfort at all.***

The original ***Narval CC*** advancement strap had a few shortcomings; the numbers were too small for most to read without a visual aide, no 0.5 mm increment and they stretched over time when challenged by a heavy bruxer. So, ***a beefier strap, with larger numbers available in 0.5 mm increments was introduced.*** Everyone was happy, until the first time a nub responsible for holding the advancement strap in place distorted, allowing the strap to dis-engage in the mouth, similar to what happens with the beefier D-SAD straps. So, it appears that ***by making the strap beefier, the role of the "Fuse" was transferred from the strap, to the engagement nubs.*** ResMed may need to revisit their strap design, perhaps going the Panthera route providing different "Brux" versions of their advancement straps for those bruxing patients that sufficiently challenge their structural integrity. ***In the meantime we need a way to manage this issue for that subset of patients.***

More Practical Pearls

Chapter 5

Advancment Straps
The Fuse Concept

Advancement Straps *cont'd*

Before we get into the solution I would like to clarify a few things. ***When patients are first becoming accustomed to mandibular advancement they challenge their appliance much more***. So, for some patients that tear through the new straps in a short time, this ***issue may subside with time.*** In addition, we now better understand that ***reducing AHI often leads to a reduction in Sleep Bruxism*** so this could also reduce breakage with time. I found this to be the case in the very early days when I made a lot of Silencer appliances. The Silencer's "Fuse" is the titanium pin holding the upper and lower component together. I found that in a subset of patients, ***breakage went from the category "Often" to "Never" with simply the passage of time.*** Some very heavy bruxers that continued to experience pin breakage even after being jumped to the alternative hinge that sported a much beefier pin, simply stopped breaking their pin with passage of time! This of course dates back to the '90's demonstrating that this is not a new issue. For some patients, it is helpful to let them spend longer with less advancement before advancing the mandible, allowing them longer to acclimatize to mandibular advancement. Finally, if advancement has caused the patient's jaw to be swayed to either the left or right of where it wants to be, the stress imposed on the straps from the jaws efforts to be in it's happy place may be sufficient to fracture a strap and cause it to disengage. So, it is always indicated to check for this issue and if it exists, simply balance jaw alignment by using a different strap number on one side, shorter or longer as required.

What you have to ask yourself is this, for your appliance of choice, where is the "Fuse" located? They all have one, even if it is the main body of the appliance itself, or the teeth or the musculature or the TMJ! I find that when appliances break, there is usually a common theme for that particular appliance, for example, ***Dorsal Style*** appliances have their advancement mechanism sheer off, ***Silencer*** appliances have their titanium pin break, ***Klearway*** appliances have a wire dis-engage from the acrylic, ***Herbst*** appliances experience breakage at the metal-acrylic interface, and ***EMA*** appliances stretch out their weaker elastic straps prematurely or sheer off the strap attachment nub when using their stiffest strap ***(indicating that the stiffer strap transfers the "Fuse" to the attachment nub)***. Maybe thinking about this "Fuse" concept will help you better understand some of the breakage issues you have experienced with your appliance of choice.

More Practical Pearls

Chapter 5

Advancment Straps
The Fuse Concept

Advancement Straps *cont'd*

So, how does one deal with the beefier Narval CC advancement straps breaking? Simply go back to the original version of the strap for that patient. Thankfully, I did not throw them away! I would rather have a strap that I monitor for stretching and replace as needed than deal with a disgruntled patient coming into the office with what he perceives to be a "Broken" appliance! The good news is that I have only experienced the original version of the strap breaking into two pieces once. Indicating to me that this is a very rare occurrence and stretching of the strap is the most likely problem you will deal with.

Let's collectively give RESMED and Panthera our feedback so they can go back to their computers and continue making these already exceptional appliances even better. These types of modification are ***relatively easy*** to accomplish due to the CAD-CAM process. It really is a New World and these appliances continue to differentiate themselves as New World appliances.

For those of you that are having a problem with this ***"fuse concept"***, think about the breakage issues you have experienced with your appliance of choice and try to determine where the "Fuse" for that particular appliance is; if you do this sincerely, you may not be too pleased with the answer. Finally, ***the electronics people figured this out a long time ago***; if I were designing a Sleep Apnea appliance, I would place the "Fuse" in the most easily and in-expensively replaced part of the appliance that caused no harm when it failed.

Where would you place the Fuse?

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Panthera D-SAD

Panthera
D-SAD

Original D-SAD Advancement Straps

Titrate by exchanging connecting straps

- **Smaller straps = greater protrusion**
- **Longer straps = less protrusion**

Four straps are included with each case

- **0.5 mm increments**
- **15 mm increments of range**

Types of Advancement Straps:

- **“B” for Heavy Bruxers**
- **“b” for Mild Bruxers**
- **“Standard” for Regular Patients**

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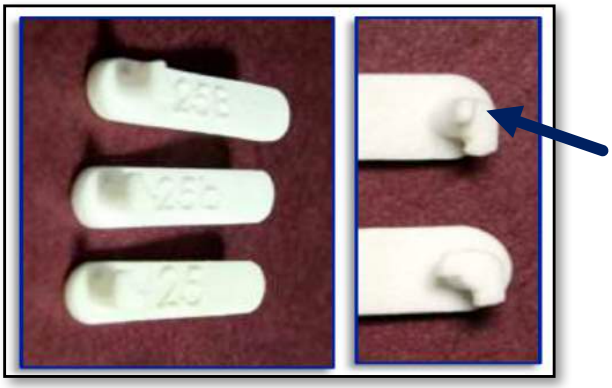
Chapter 6

Panthera D-SAD

Advancement Straps *cont'd*

The D-SAD online order form previously provided a section under "Other Options" where you could specify if you are dealing with "Light-Moderate" or "Severe" Bruxism. Bruxism straps were included with the appliance when "Severe" bruxism was indicated. Below, you see pictured the "regular", "b" for light bruxer and "B" for heavy bruxer straps. However, this has all changed as of February 8, 2019 **(SEE NEXT PAGE)**

For clinicians in Europe that still have access to the Narval CC, the new, beefier straps are more prone to having the nubs distort and pull out of the engagement hole as discussed in the previous article. If this problem persists, one option is to switch them out for a first generation strap. With time, as the patient is resisting the appliance position with less force you will in all likelihood be able to revert to the beefier Straps once again.



Use either a "b" or "B" strap for Bruxers. See how a regular strap deforms and pulls out of appliance with heavy bruxing.

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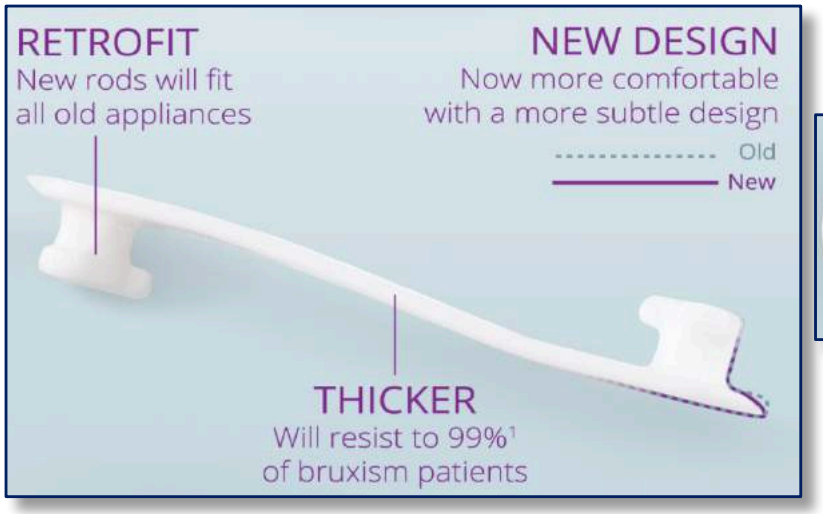
Chapter 6

Panthera D-SAD

Advancement Straps *cont'd*

New D-SAD Advancement Straps: Available February 8, 2019

The Panthera D-SAD is now delivered with **RODS 2.0**. A new and improved advancement ROD. Panthera's research has determined that this new beefier advancement strap will be able to handle 99% of bruxers needs. When patients require more strength, they will provide an even beefier strap called **RODS+,** which cannot be ordered. ***The new RODS+ will be provided when deemed necessary by Panthera's quality control and/or customer service.***



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Chapter 6

Panthera D-SAD

D-SAD Script Information

PROTRUSIVE BITE

- ☐ Bite represents maximum (100%) of protrusion
- ☐ Bite represents starting point

You have the choice of documenting 100% of protrusion or your desired starting position

LATERAL DEVIATION

- ☐ None
- ☐ Yes

You are asked to document whether or not the patient deviates with advancement

VERTICAL DIMENSION

- ☐ Close as needed
- ☐ Keep it, call if changes needed

You are asked how committed you are to the vertical you have registered

BRUXISM

- ☐ None
- ☐ Light-moderate
- ☐ Severe

You are asked about the patient's Bruxing status

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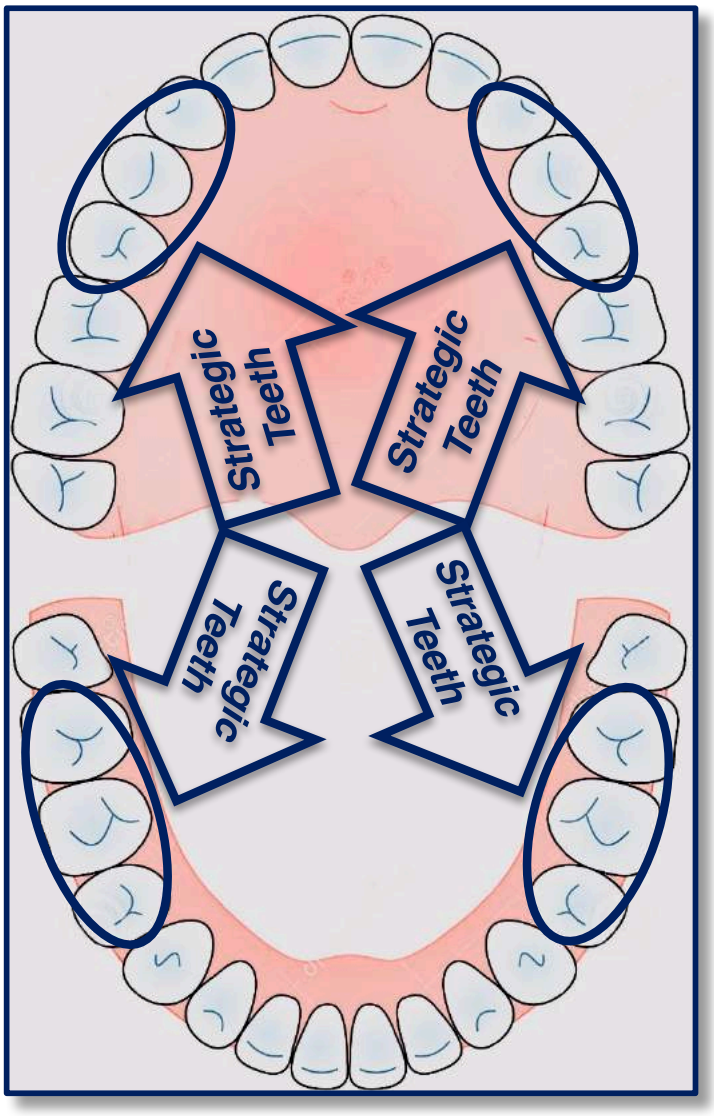
Chapter 6

Panthera D-SAD



Important Teeth for Retention

The D-SAD appliance is retained by engaging the cuspid to the last molar in each quadrant. The strap attaching the upper and lower components runs from the labial of the upper cuspid to the buccal of the lower molars. The most important teeth for retention are outlined in the diagram to the left.

Patient Selection

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- ***Apparently those with Large arches also!***
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- ***Patients with future anterior dental work***
- ***Patients with anterior sensitivity***
- ***Patients adverse to metallic appliances***
- ***Patients with allergy restrictions***

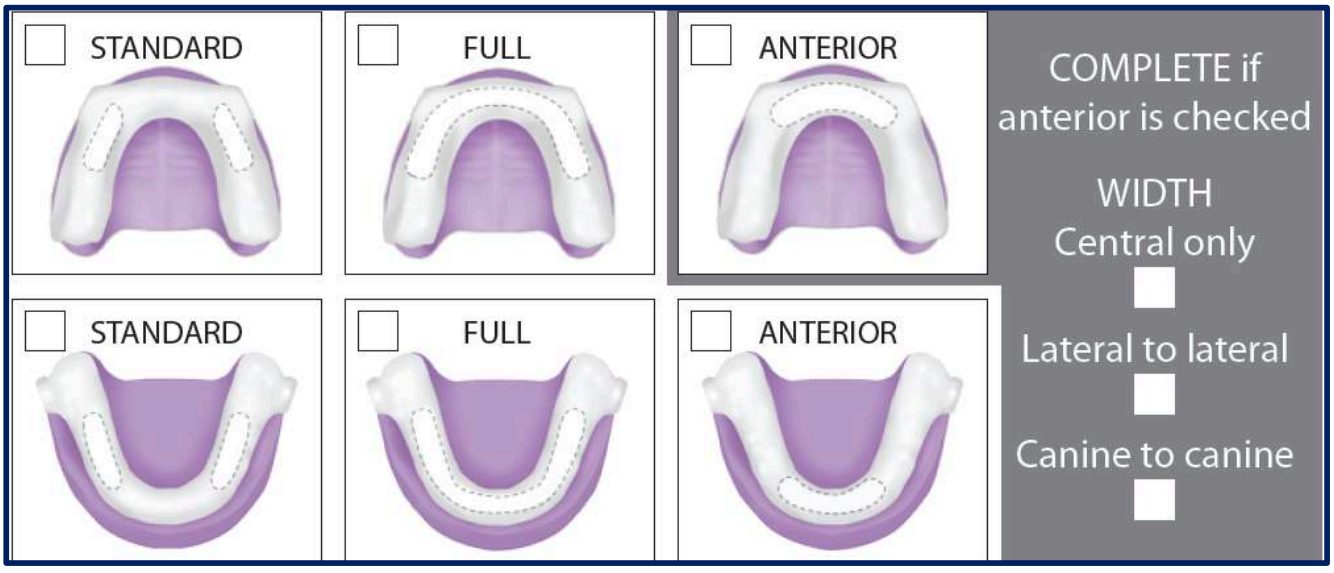
More Practical Pearls

Chapter 6

Panthera D-SAD

D-SAD Body Platform Selection

The order form for the D-SAD allows you to select from a number of options regarding point of contact. You can chose “Use Optimal Values” which will authorize the technician designing the appliance to determine where the point of contact should be, or, you can choose “”Customized”, which will allow you to define exactly where you want the contact to be. When selecting the “Anterior” contact, you can define over which teeth the contact is to occur, the options being, over the centrals, over lateral to lateral, or over canine to canine.



More Practical Pearls

Chapter 6

Panthera D-SAD

Band Options

In Diagram 1 and 2 below a mid-sagittal cross section view shows the device and dentition depicting the various band designs. These bands can run along the labial exclusively, Lingual/Palatal exclusively, or they can run over the incisal edge incorporating both the Labial and Lingual/Palatal.

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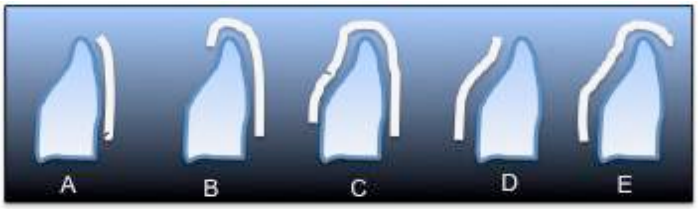

Band Styles For Mandible:
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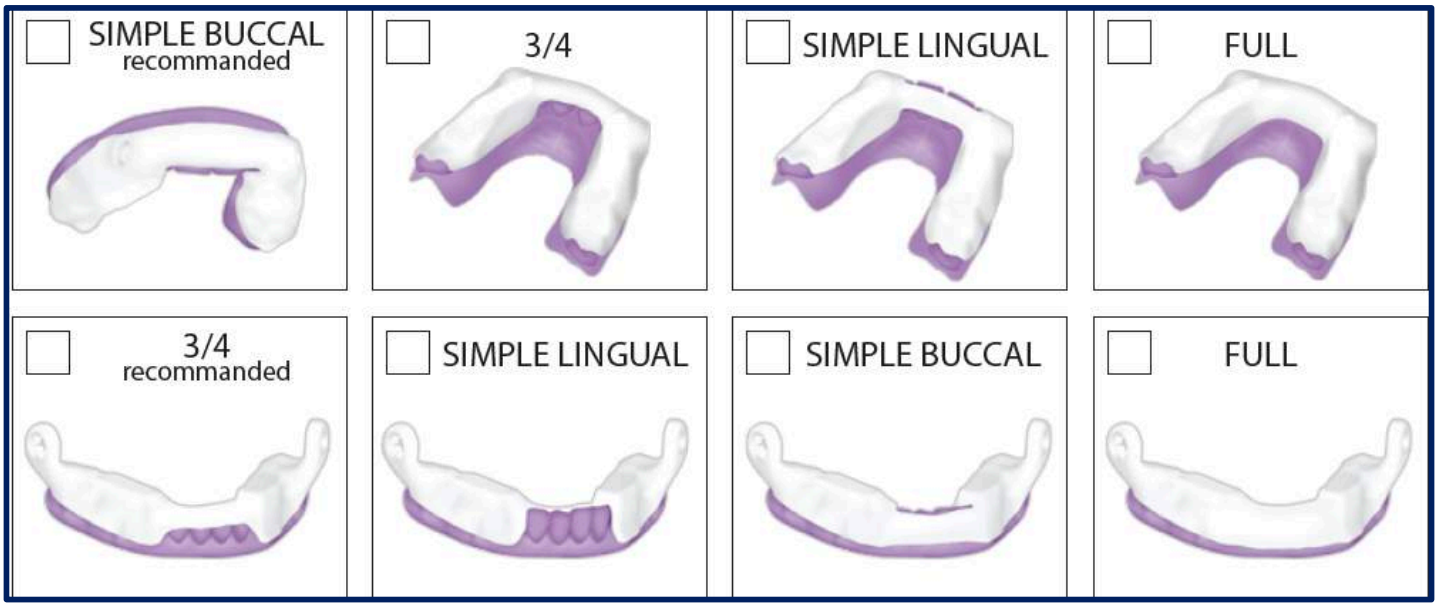
More Practical Pearls

Chapter 6

Panthera D-SAD

D-SAD Anterior Band Selection



More Practical Pearls

Chapter 6

Panthera D-SAD

D-SAD Anterior Band Selection and Tooth Movement

Panthera recommends the "Simple Buccal" strap for the maxillary component of their D-SAD appliance. However, I have found this design to lead to anterior tilting of the upper incisors in a subset of patients. With no palatal coverage of the dentition, the tongue is free to press up against the lingual and palatal of the anterior dentition. As we all know, any level of pressure on a tooth will lead to movement of that tooth, the only unknown is how much and how quickly. So, in cases when I want to absolutely protect the teeth from such movement I prescribe a band that protects the teeth from this tongue pressure ***(see below)***.

In some cases, labial tilting of the anterior dentition would actually enhance the patient's bite, due to over-crowding, or palatally tilted incisors. For these patients, I am OK to prescribe the Simple Buccal band if the patient after being advised of the potential for this tooth movement is in agreement. Of course, get this agreement in writing!

These appliances incorporate a unique band of nylon that attaches the right and left side without contacting the anterior teeth. The design of this band is in our control when prescribing these devices and selecting the wrong design can result in unfavorable outcomes, potentially impacting on "***Tooth Movement"*** and ***"Retention"***.

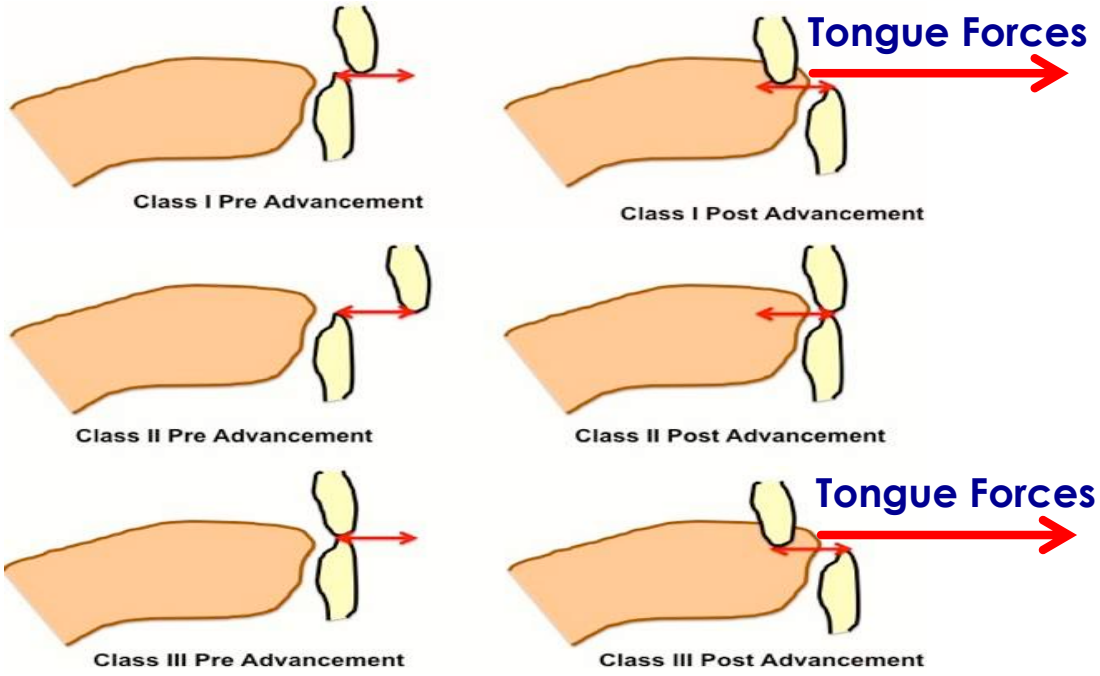
Keep in mind that ***labial tilting of the anterior incisors does not happen with all patients.*** My theory on this has to do with just how much pressure is placed on the dentition. For example. A **Class I** or **Class III** patient will likely exert much more pressure on the anterior maxillary incisors than an extreme **Class II** patient, even with exactly the same level of advancement. The diagrams on the next page demonstrate why.

More Practical Pearls

Chapter 6

Panthera D-SAD

Anterior Band Selection and Tooth Movement



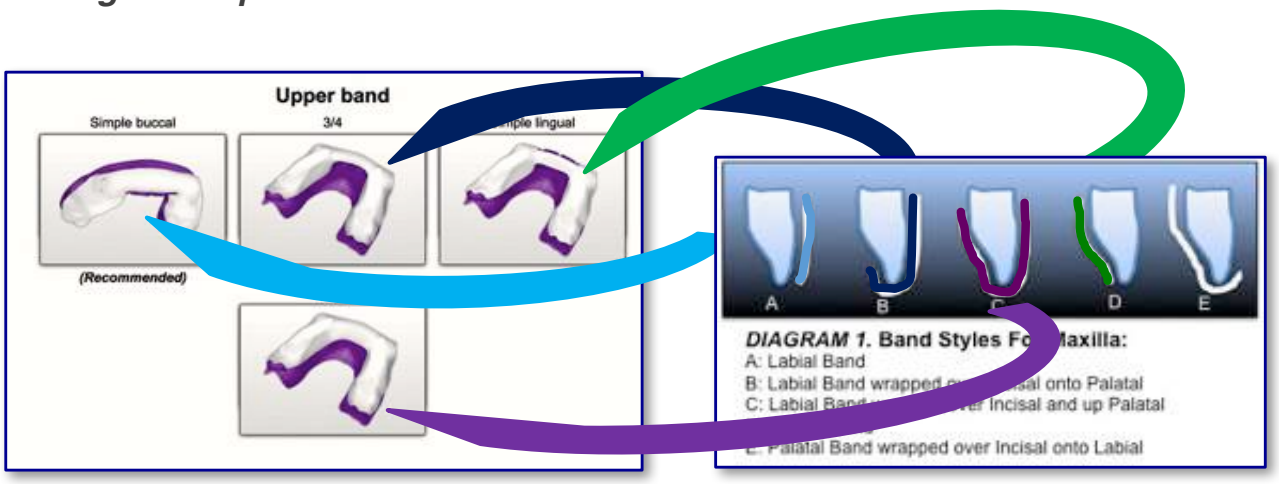
In the diagrams above, even with the same level of advancement, it is clear that the tongue is more likely to be pushed up against the palatal of the maxillary dentition with a Class I bite and Class III bite than with a Class II bite. The pressure created by the tongue pressing up against these teeth is what leads to the labial tilting witnessed in some patients, and the degree of tilting is dependent on the degree of pressure placed by the tongue on this dentition.

Panthera D-SAD

Anterior Band Selection and Tooth Movement

NOTE: I have not witnessed this labial tilting when the teeth are protected with the band design that covers the palatal of the maxillary anterior teeth. Also, I have been monitoring Class II dentitions that have been wearing a labial style band (Simple Buccal) and ***to date,*** I find that they are free of the labial tilting discussed above. That is not to say that this tilting will not become evident with passage of time.

To summarize, labial tilting of the maxillary dentition may occur with the Simple Buccal band, depending on the starting bite. However, this tooth movement seems to be more associated with Class I and Class III bites. Observation to date seems to indicate that labial tilting of the maxillary incisors can be prevented (or minimized) by simply choosing a band that covers the palate of the maxillary anterior teeth. Or, as discussed above, this tooth movement could be used to your advantage if the patient would benefit from such movement.



Panthera D-SAD Maxillary Band Choices

More Practical Pearls

Chapter 6

Panthera D-SAD

D-SAD Anterior Band Selection and Retention

Panthera originally provided their standard appliance with a Lingual band on the lower arch and a Labial band on the upper arch. Clinical experiences led to a change to having the mandibular band wrap from the lingual side over the incisal onto the labial ***(see image below)***. The main reasoning for this was the increase in retention that came with making the lower arch of the appliance stiffer so that the undercuts from each side of the lower arch could play off each other. A second reason was that in the first generation nylon appliances, there were reports of band fracture with excessive bending or torqueing when removing the appliance from the dentition and this wrap over design makes the band stiffer and of course stronger, protecting from this eventuality. Currently, the D-SAD appliance comes standard with a Labial Band on the maxillae and a Lingual Band with wrap over the incisal onto the labial for the mandible, but If you want a different configuration you simply specify so on their prescription form.

Panthera D-SAD Mandibular Band Choices

More Practical Pearls

Chapter 6

Panthera D-SAD

D-SAD (Recommended Version)

Maxillary labial band.

Mandibular lingual band with incisal cap.

Enhances Mandibular retention but does not protect Maxillary incisors from tongue forces leading to labial tilting of Maxillary incisors in some patients. I prefer using a Maxillary band that wraps over the Incisal to help prevent tongue forces from causing tooth movement.

More Practical Pearls

Chapter 6

Panthera D-SAD

Adherence Monitoring

The Panthera D-SAD appliance is compatible with the DentiTrac Compliance monitor by Braebon; facilitating documentation of patient adherence to treatment.

Panthera Dental secured a Patent on placement of a ***Compliance Chip on their advancement strap.*** The system they have developed provides many options. Backward compatible, the strap will work with any D-SAD appliance you have already inserted. Or in the alternative, it can be added in the future should you decide an appliance you insert today requires adherence testing at a later date. Should you want to start with compliance monitoring from the get go, you would first establish a titration end point and then order the compliance chip and special strap in the final endpoint size. If a different strap size is needed in the future (eg, due to patient weight gain) then a different size strap can be ordered and the existing compliance chip can be jumped to the new strap right in your office.

DentiTrac Compliance Chip

Panthera D-Sad with DentiTrac Compliance Chip in Strap

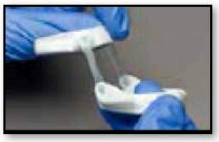
More Practical Pearls

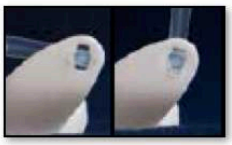
Chapter 7

ResMed Narval CC

ResMed Narval CC

- Titrate by exchanging connecting rods
  - Smaller rods = greater protrusion
  - Longer rods = less protrusion
- Full complement of connecting rods are included with each case
  - Rods are offered in 0.5 mm increments
  - 20 mm increments of range





Questions on Lab Script:

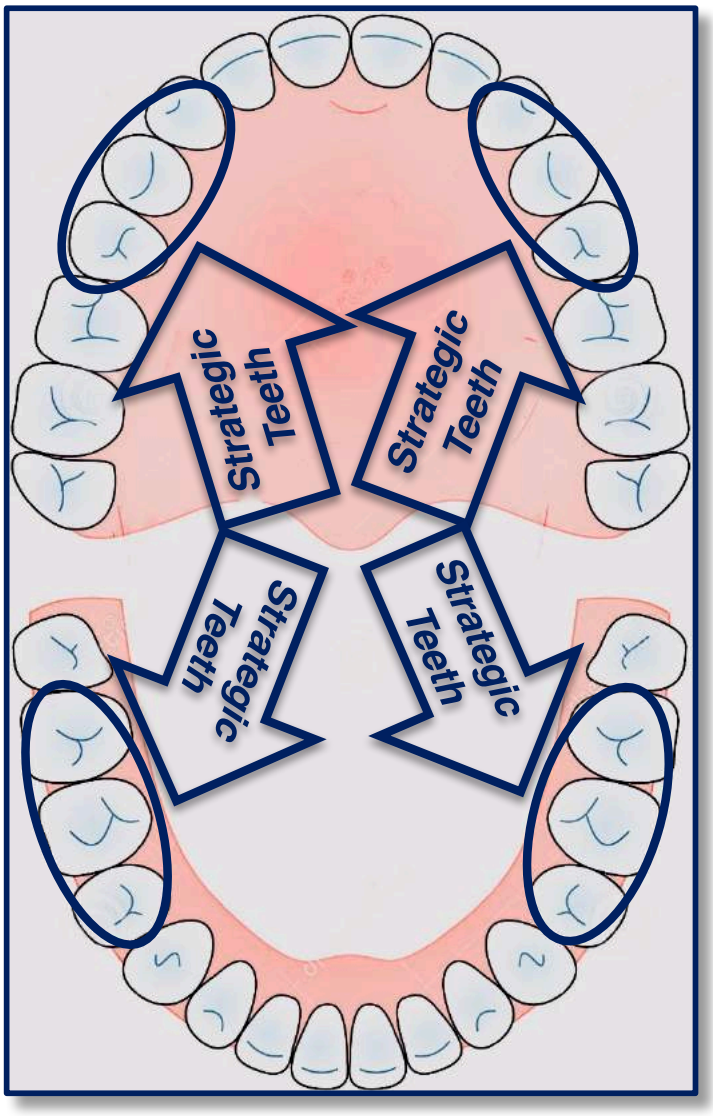
Is full coverage acceptable? I usually answer yes.
Are elastics desired for this case? I ALWAYS answer yes.
Is distal wrap preferred on this case? I usually answer yes provided there are no soft tissue conflicts.

It is also a good idea to document any mandibular deviation with advancement and just how committed you are to the vertical you have selected in case they want to modify it.

More Practical Pearls

Chapter 7

ResMed Narval CC



Important Teeth for Retention

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More Practical Pearls

Chapter 7

ResMed Narval CC

Band Options

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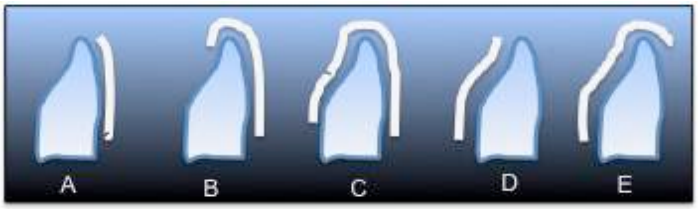

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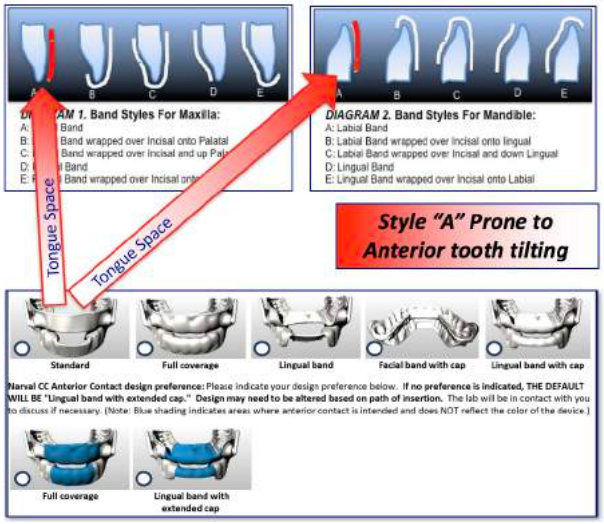
More Practical Pearls

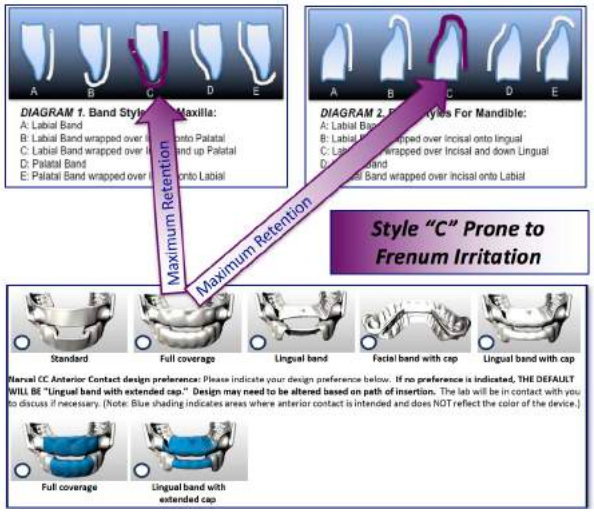
Chapter 7

ResMed Narval CC

Narval CC Anterior Band Selection



Narval CC Standard Band



Narval CC Full Coverage Band

More Practical Pearls

Chapter 7

ResMed Narval CC

Narval CC Anterior Band Selection

Narval CC Full Coverage Band

The **"Full Coverage"** band is used when retention is questionable or lacking. It also provides full protection from labial tilting of the anterior dentition. The band does not make any contact with the dentition and it does not allow the tongue to press up against the teeth protecting them from tooth-moving forces. The retention is enhanced with this band because the stiffness created when the nylon is wrapped over the anterior teeth allows the undercuts from each side of the appliance to play off each other rather than being restricted to playing off each other from within the same quadrant.

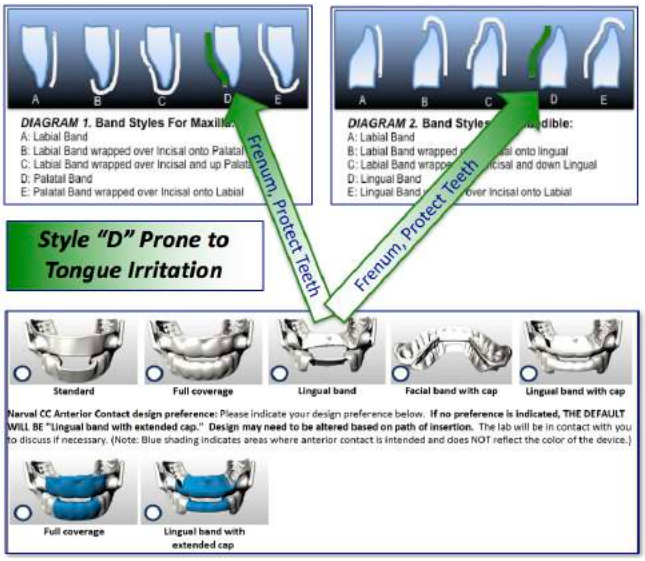
One thing to consider when prescribing this band is the Frenum. In the case of a large Frenum, the patient may find the full wrap band uncomfortable if it rubs up against the Frenum. Although, this could likely be remedied by grinding away the part of the Band that is rubbing up against the Frenum in a similar way as when you grind away acrylic on a denture that is impinging on the Frenum. ***Ensure a smooth "Oval" shaped remove rather than a "V" shaped removal to maintain structural strength of the Nylon. A "V" shaped cut out creates a stress point at the point of the "V" that could lead to a tear in the Nylon over time.***

More Practical Pearls

Chapter 7

ResMed Narval CC

Narval CC Anterior Band Selection

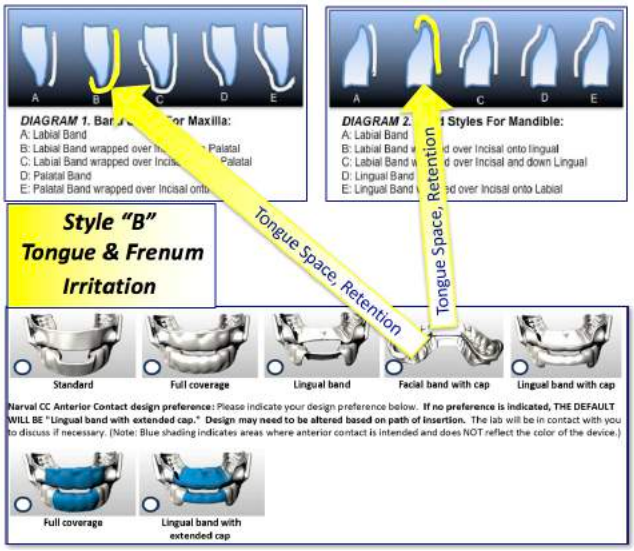


Narval CC Lingual Coverage Band

The **"Lingual"** band is as flexible as the Standard band previously described. It will provide protection from labial tilting caused by tongue pressure but does nothing to aid in retention. In addition, this band could be useful when there is a large Frenum.

ResMed Narval CC

Narval CC Anterior Band Selection



Narval CC Facial Band with Cap

The **"Facial Band with Cap"** provides more stiffness than the Standard and Lingual bands but less stiffness than the Full Coverage band. As expected, the Facial Band with Cap aides with retention more so than the Standard and Lingual bands, but not as much as the Full Coverage band.

Of course, this band provides more tongue space as it does not wrap onto the lingual and palatal. So, when looking to increase retention but also maximize tongue space this band may be the answer. ***However, it provides no protection from tooth movement caused by tongue pressures.***

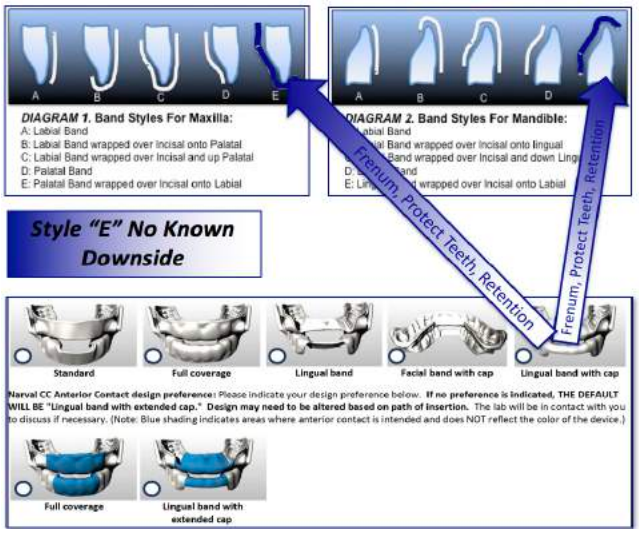
Unfortunately, some patients complain about their tongue rubbing up against the edge of the nylon that wraps onto the palatal and lingual of the dentition. The problem is trying to forecast which patient will complain; good luck with that! I personally avoid this design for solely this reason.

More Practical Pearls

Chapter 7

ResMed Narval CC

Narval CC Anterior Band Selection



Narval CC Lingual Band with Cap

The **"Lingual Wrap with Cap"** band provides more stiffness thus aiding in retention, protects the teeth from tongue pressure and the associated labial tilting of the dentition and also works well in large Frenum cases.

This is my favorite design as it enables retentive undercuts from both sides of the appliance to play off each other, thus enhancing retention, provides the teeth protection from tooth movement pressures and also protects from irritation to the Frenum and inner lip caused in some patients with the Labial (Standard) band design. I believe that you obtain a lot of benefit in exchange for the little bit of tongue space lost with this design.

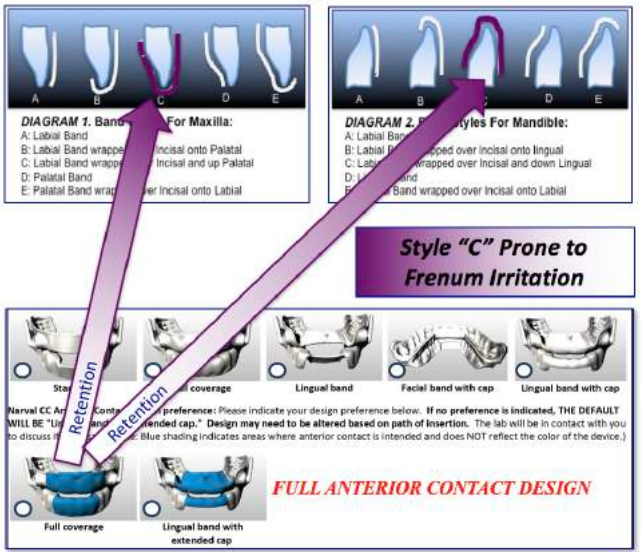
More Practical Pearls

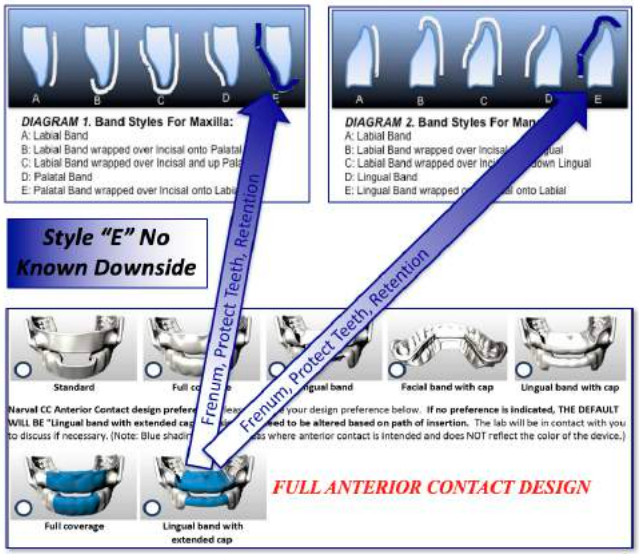
Chapter 7

ResMed Narval CC

Narval CC Anterior Band Selection

Full Anterior Contact





The Narval CC script also allows one to select "Full Anterior Contact". This feature was added due to end user request. Although this option does not appear on the Panthera D-SAD script, the D-SAD can also be manufactured with full anterior contact. Please note that there is no retention on the anterior teeth, simply contact.

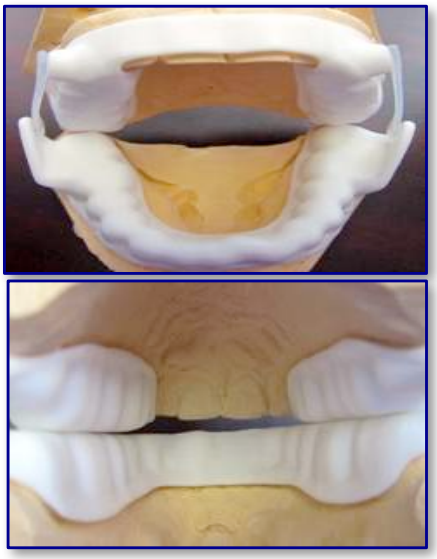
Regarding implications of Band design for the D-SAD, everything that you've read about the Narval CC in the previous section also applies to the Band choices available on the Panthera D-SAD.

More Practical Pearls

Chapter 7

ResMed Narval CC

Upper & Lower Components with Labial Bands only. Maximum tongue space but susceptible to labial tilting of maxillary incisors and may irritate frenum.



Standard maxillary band and full wrap mandibular band. Maximizes mandibular retention but does not Protect Maxillary incisors from tongue forces leading to labial tilting of maxillary incisors.

More Practical Pearls

ResMed Narval CC

Maxillary palatal band with incisal cap.
Mandibular lingual band with incisal cap.
Enhances retention for both arches, provides maximum protection from tooth movement and Frenum irritation.

More Practical Pearls

Chapter 8

Panthera X3

Panthera X3: 3 Appliances in 1

A dorsal style appliance that allows the clinician to define the angle of the fins.

Similar to NorSnore

Similar to Micro2

Similar to Standard Dorsal

CAD/CAM Designed and Manufactured
Compatible with Intra-Oral Scanner
Titration Intervals

- -1, 0, 1, 2, & 3 mm
- 0.5mm step Option

More Practical Pearls

Chapter 8

Panthera X3

Panthera X3: 3 Appliances in 1

A dorsal style appliance that allows the clinician to define the angle of the fins.

An exciting new appliance offering that once again demonstrates what is possible when working in a CAD/CAM environment. Panthera was ready to introduce this appliance when ResMed announced that they were leaving the North American market so this project was put on hold temporarily. But, watch for it…

More Practical Pearls

Chapter 9

Oventus

Oventus: The Nylon Appliance

The Oventus is an EMA-style appliance, made of PA2200 non-filled, white powder, on basis of type 12 Polyamide Nylon, and is 3D Printed. A channel allows and facilitates airflow even when pharyngeal collapse is taking place. EMA advancement straps are compatible with the Oventus. There are also plans to develop Nylon advancement straps in a limited size range.

As of the publication of this eBook the Oventus will be available in Australia by years end, in Canada by early 2019, followed by the US once FDA clearance is in place, perhaps during the 2nd quarter of 2019.

- **Ability to manage nasal obstructers as well as non-nasal obstructers**
- **Reduces negative pharyngeal pressure swings**
- **By-passes problematic velo-pharyngeal blockage**
- **Addition of PEEP valve helps stabilize end expiratory pressure**
- **Reduces PAP pressure requirements**
- **Eliminates need for PAP Mask**

More Practical Pearls

Chapter 9

Oventus

Oventus Nylon Appliance

Oventus O_2Vent™ Currently in Market

Oventus O_2Vent™ + ExVent™ oral EPAP
Expected to be released in Q4 2019

Oventus O_2Vent™ + ONEPAP™ oral/nasal EPAP
In late stage development

Oventus O_2Vent™ Connect CPAP connection
In late stage development

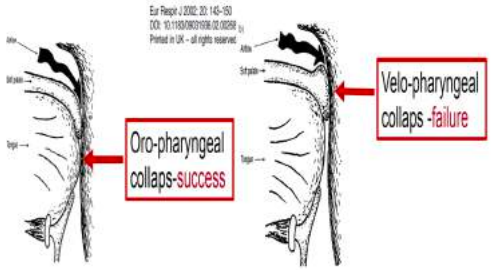
The Oventus platform revolves around the notion of achieving optimal success with minimal intervention. The built in breathing chamber that facilitates mouth breathing and by-passes the problematic palatal blockage area, seems to be counter-intuitive considering what we know about the importance of nasal breathing. However, there are a subset of patients that remain nasally compromised, even post surgical intervention and this may be the appliance of choice for them. Early studies demonstrate a usefulness far beyond this subgroup.

More Practical Pearls

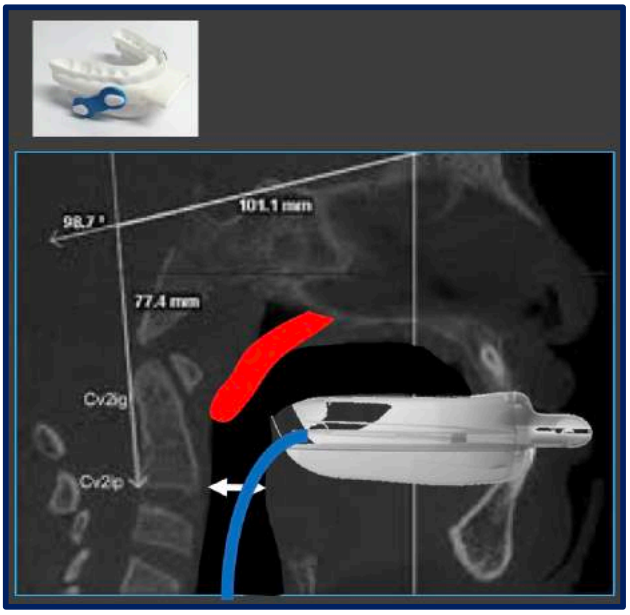
Chapter 9

Oventus

Oventus: The Concept



- ***MRI of pharynx and treatment efficacy of a mandibular advancement device in OSAS***
- ***OA Success tied to Velo-pharyngeal collapse***



- ***Airflow through appliance channel bypasses velo-pharyngeal collapse***

More Practical Pearls

Oventus

Oventus: The Concept

Traditional lower jaw advancement (competitor products)	Oventus O_2 Vent™	Oventus O_2 Vent™ + EPAP	Oventus O_2 Vent™ + Connect
Mandibular advancement splints			
41%[1] of patients treated successfully	54%[1] of patients treated successfully	83%[2] of patients treated successfully	100%[3] of patients treated successfully

1. *McCloy K. et al., Abstract Submitted ASA Brisbane 2018*
2. *Lai V. et al., Abstract Submitted ASA Brisbane 2018*
3. *Amatoury J. et al., Abstract Supplement ADSM Boston 2017*

**** AHI < 10 and 50% reduction***

More Practical Pearls

Chapter 9

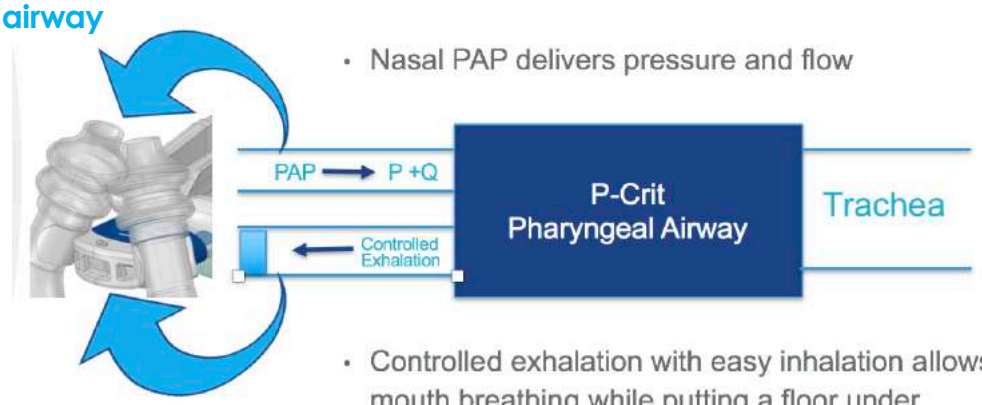
Oventus

Oventus O_2Vent™ + ONEPAP™ oral/nasal EPAP In late stage development

Oro-nasal EPAP **"ONEPAP"**
Titratable true PEEP valve delivering constant pressure on exhalation

Oventus O_2Vent™ + Connect PAP Connection coming soon

PAP pressurizes airway



PEEP valve controls exhalation

More Practical Pearls

Chapter 9

Oventus

Oventus: Evidence Update

In 2017, Lavery et al. published their findings on the safety and efficacy of the Oventus 0_2Vent Mono Block appliance for the management Obstructive Sleep Apnea. The study had an n of 29, and incorporated participants of relatively severe OSA. They concluded that this device is safe, effective, and well tolerated with a clinically and statistically significant reduction in AHI of 62% as well as improvement in oxygen saturation. Neither efficacy nor response was reduced by the presence of nasal obstruction.

There has been much ongoing research activity in Australia regarding the Oventus O_2Vent appliance platform. In October 2018, 5 Abstracts were presented by various groups at the European Respiratory Society International Congress and the Sleep Down Under Annual Conference.

AIRWAY OPEN-AIRWAY CLOSED: Lavery, Szollosi, Moldavtsev, McCloy and Hart

This study with an n of 32, aimed to determine the effects of the built-in airway on treatment response measured using the Apnea Hypopnea Index (AHI). The results demonstrated the benefit of adding an Oral Airway. The addition of an Oral Airway to proven non-responders, reduced their residual AHI a further 20% and resulted in 6 of the 17 non-responders to become Oral Appliance Responders. Overall, the authors found that treatment response was similar with and without an Oral Airway, with much inter-individual variability. However, when a significant differential response occurred, it more frequently favored the Oral Airway. Patients that failed to respond on traditional Oral Appliance treatment with no Oral Airway, and those with higher inspiratory nasal resistance tended to respond more favorably to an Appliance with an Oral Airway.

Oventus

Oventus: Evidence Update *cont'd*

Combination therapy with mandibular advancement and expiratory positive airway pressure valves reduces OSA severity: Lai, Tong, Tran, Ricciardeiello, Donegan, Murray, Carberry and Eckert

This study of n=22, aimed to determine if combination therapy with an oral appliance that has a built-in oral airway (O2VentT™) and Oral or Oro-Nasal PEEP valves, reduces OSA severity for incomplete oral appliance responders. It demonstrated that the addition of both Oral and Oro-Nasal PEEP valves to the base appliance that had an Oral Airway resulted in a reduction in OSA severity to therapeutic levels for approximately 60% of participants who were incomplete responders to the appliance alone. They also found that addition of the Oral PEEP valve significantly reduced residual events by 30% (p,.02) and that the addition of Oro-Nasal PEEP valves significantly reduced residual events by 50% (p<.02).

Combination therapy with CPAP plus MAS reduces CPAP therapeutic requirements in incomplete MAS responders: Tong, Tran, Ricciardiello, Donegan, Murray, Chiang, Szollosi, Amatour, Carberry and Eckert

Preliminary results (n=16) of a study investigating the combination of PAP with an Oral Appliance for incomplete Oral Appliance Responders resulted in approximately 35-45% lower PAP pressure requirements and normalized pharyngeal pressure swings to a level similar to PAP alone. The results were similar with and without an Oral Airway indicating that patients can continue to breathe through the device airway while delivering nCPAP without losing airway stability eliminating the need for full face masks.

Oventus

Oventus: Evidence Update *cont'd*

Postural effects on nasal resistance in obstructive sleep apnoea (OSA) and efficacy of a novel oral appliance: Tong, Tran, Ricciardiello, Donegan, Murray, Chiang, Amatoury, Carberry and Eckert

This study of n=39 aimed to assess the effects of posture and mandibular advancement on nasal resistance in people with OSA and determine the efficacy of a novel oral appliance that incorporates an oral route of breathing in people with OSA including those with high nasal resistance. The results showed that nasal resistance increased not only from the seated to the supine position but increased again in the lateral position. The Oventus O_2 Vent reduced AHI by approximately 50% with similar reductions in those with and without increased nasal resistance.

Predictors of Response to a Novel Mandibular Advancement Device (Oventus O2Vent T) in patients with OSA: Walsh, Maddison, Baker, Pantin, Lim, Szollosi, McArdle, Hillman and Eastwood

Preliminary results (n=22) of a study designed to investigate predictors of response to an appliance with an Oral Airway demonstrated that the Oventus O_2 Vent reduced AHI by approximately 40% with the Oral Airway Open or closed. The results demonstrated an even better result for those patients with lower nasal resistance. The authors concluded that access to oral breathing may be of benefit for certain subgroups; females, smaller neck circumference and lower waist/hip ratio.

More Practical Pearls

Chapter 9

Oventus

Oventus: Conclusion

The innovative and unique Oventus treatment platform is being designed to provide the ability to move through various steps of intervention, beginning with simply the base appliance, the Oventus O_2Vent Optima, and progressing to the addition of a simple PEEP valve, a titratable Oral-nasal PEEP valve and finally the addition of PAP. The platform allows for adaptability to a next level of therapy if the current therapy step has less than desired efficacy of treatment such as residual apnea or patient symptoms persist.

Although the science is early and immature, the concept is certainly intriguing and worthy of further investigation; by-passing the problematic velopharynx and/or nasal patency issues, the addition of Positive End Expiratory Pressure control and making this resistance titratable, and finally the addition of PAP if necessary. ***While we are waiting for more evidence, for those patients that are nasally compromised, this appliance may be the answer.***

Oventus with PEEP Valve

Practical Pearl: A full 3 mm of gingiva beyond tooth structure is required in your scan or models to fabricate the Oventus appliance. There are areas that this may not be necessary, but especially in the premolar region (for patients with short crowns), the CAD/CAM manufacturing process requires that level of information on patient anatomy for accurate placement of the lugs that hold the advancement straps. Of course, this level of information also helps to ensure that the scans are consistent and will reduce the requirement for rescanning patients and/or appliance remakes; which no one benefits from.

More Practical Pearls

Chapter 10

Diamond Digital Sleep Orthotic DDSO

DDSO Nylon Appliance

The DDSO Nylon appliance is an EMA-like design appliance. It is currently available in Canada, and both FDA approval and availability in the USA is forecasted to be early 2019.

The DDSO appliance can be currently ordered with 2 alternative strap systems.

Nylon Straps: This version of the DDSO comes with screw on and off buttons to exchange the straps. The appliance is provided with 4 nylon straps (18, 19, 20, 21) allowing for three 1 mm advancements from the starting position. More straps allowing for further advancement can be ordered.

Medical Grade Sanoprene Straps: This version of the DDSO comes with 4 straps; 2 straps (20, 21) allowing a 1 mm advancement from starting position in a higher durometer (elasticity) and 2 straps (20, 21) allowing a 1 mm advancement from starting position in a lower durometer (elasticity). There are plans to increase this to 5 straps (17, 18, 19, 20, 21) for each durometer, which will allow 4 mm of advancement for each of the two durometers. It is also an option to order EMA Elastomeric straps to allow further titration if necessary.

Both DDSO appliance versions, allow for Vertical titration and addition of modular tongue positioners and a quick disconnect for a PAP mask. Vertical adjustability is possible from 1 to 5 mmm by adding shims which can be placed on the anterior (creating an Anterior Midpoint Discluding Stop) or both posterior and anterior (creating a Tripod Occlusion).

More Practical Pearls

Chapter 10

Diamond Digital Sleep Orthotic DDSO

DDSO Nylon Appliance: The Key Features

5 Year Unconditional Warranty ($100 reprint fee.) If the patent loses the device, breaks it, the dog eats it, regardless of the issue, it will be replaced for $100.

DDSO

Adjustment Bands

Tongue Positioners

More Practical Pearls

Chapter 10

Diamond Digital Sleep Orthotic DDSO

DDSO Nylon Appliance: The Key Features

Optional tongue lifters (Encourages Proper Tongue Posture)

Option to attach CPAP Pro for combo PAP / OA therapy

Optional detachable pads to alter Vertical

Working in a CAD/CAM environment has allowed the developers of the DDSO to incorporate various very desirable features from other existing appliances into one appliance; virtually impossible without the CAD/CAM medium.

More Practical Pearls

Chapter 11

Maintenance

Appliance Maintenance

Panthera provides a starter kit for ***NovaDent*** with each case. Although I have not researched all the different appliance cleaners on the market I do want to share with you just how well this cleaning agent works. ***NovaDent*** is produced in Quebec Canada, info can be found at ***NovaDent.com.*** The starter kit and cleaning powder can be ordered on-line at ***NovaDent.com*** or by phone at ***1-800-474-6682***. I highly recommend it.

NovaDent is a daily cleaning solution for all types of oral appliances. It requires no brushing and eliminates 99.9% of bacteria and viruses and 100% of tartar, odours and stains. Fully biodegradable, Novadent is both acid and chlorine free, and its mild formula does not damage oral appliances. It comes in a 5-gram pre-dosed pouch, once mixed with water the powder/water solution stays active for a period of seven consecutive days.

This product comes with its own bathing bath and the powder that is used remains active for one week. So, every day when you wake up you simply rinse the appliance and place into the container containing the water and dissolved powder. It sits in this solution until you are ready to wear it again. At this point, there is a basket inside the container that allows you to lift the appliance out of the soaking bath, you rinse it with fresh water and place it in your mouth. ***This product is absolutely amazing in that it maintains the appearance as it was the day it was inserted.*** Even in the event an alternative product has been used or the patient has been somewhat neglectful and the appliance has developed a coating or has become unsightly, by simply soaking it in this solution for several days the appliance will return to what it looked like the day it was delivered.

More Practical Pearls

Chapter 11

Maintenance

Appliance Maintenance

A clean appliance may not make the appliance work better, but it certainly makes it a lot more pleasant to wear (and adjust!). I recommend using this product to all of my sleep patients that wear Nylon appliances.

Initially, I used Polident to clean my Nylon appliance. However, over time it had developed a "yellowy" hue to it. I believed that it was disinfecting and cleaning my appliance, but it was no longer the attractive white appliance that I started with. After seeing how pristine the NovaDent product was keeping the D-SAD appliances I have inserted (these patients are provided a starter kit with each appliance and most of them actually order and use this cleaning product). I decided to order NovaDent for my own personal use. It took about two weeks of use and my appliance looked EXACTLY like the day I first received it from the lab! I was thrilled!

More Practical Pearls

Chapter 11

Maintenance

NOVADent Precaution:

For some, but not all patients, a whitish buildup accumulates inside the Nylon appliance, especially where the advancement strap attaches on the upper component (for the Narval and D-SAD). This buildup is of lower ph, and actually causes decalcification of the enamel. I advise patients to use their toothbrush once a week to clean the inside of their appliance or where ever they witness any buildup.

Below you see decalcification after several months of use. I handled it by enameloplasty of the decalcified enamel and advising the patient about the buildup in his appliance and how to avoid it. See pictures below.

More Practical Pearls

Chapter 12

Adjusting and Polishing

Adjusting and Polishing

Type 12 organic polyamide nylon has a unique character unlike any dental material we have used to date. Their slight and fragile appearance is quite deceiving. Typically, when first working with this material one is almost fearful of adjusting it for fear of irreversibly damaging it. However, as has already been discussed, they are very durable and with some readily available tools they can be easily adjusted and polished so that the appliance you deliver post adjustment is as pristine as the appliance received from the laboratory. Below, I will describe two polishing techniques for these sleep apnea appliances.

Fabulustre and Felt Discs

This technique, first explained to me by ***Diane Robichaud DT*** of Panthera Dental, utilizes a polishing paste named ***Fabulustre*** and ***felt polishing wheels*** which can be used on a slow speed hand-piece when mounted on a mandrel. Fabulustre compound helps create a smooth finish. To avoid surface drag-lines do not allow the buffing action to create too much heat. So, a light touch is all it takes. First use a ***Firm Felt Disc*** to remove all the imperfections. Then do a final polish with a ***Soft Felt Disc***. Use the Fabultutre paste with both felt discs. This process will remove the burs and fur-like texture left behind after adjusting with an acrylic bur.

More Practical Pearls

Chapter 12

Adjusting and Polishing

Erkodent Polishing Discs

This technique, first explained to me by ***Lionel Dwyer DT of Orthodent Laboratories*** is my personal favorite. It utilizes ***Erkodent Polishing Discs***. After adjusting with an acrylic bur, first use the ***Coarse Erkodent Polishing Disc,*** which does a wonderful job at removing the burs and tags, and then polish the surface with the ***Lisko-S Turqoise Polishing Disc***. This disc is impregnated with a polishing compound and actually results in a shiny finish. Of course, as with the Fabulustre technique discussed above, ensure you do not generate any heat to avoid drag-lines when using this polishing disc. ***A light touch is all you need.***

Details on Polishing Discs by Erkodent:

Erkodent makes a fine, medium and coarse pre-polishing disc. These discs have an open structure for cooling and work well on soft surfaces. They are well suited for grinding, smoothing and pre-polishing the nylon prior to final finish polish with the Lisko-S Turquoise disc. The maximum recommended hand-piece speed is 4000 Rev/Min, and they are to be used with light pressure.

I have the Coarse Brown disc only and find that often, going directly to the Lisko-S Turquoise disc immediately after the acrylic bur gives me a very nice finish and saves me a step. If you decide to order these coarser discs you may consider ordering an assorted package of 10 (part#223105) which has a sampling of Fine, Medium and Coarse discs for you to establish what works best in your hands.

Adjusting and Polishing

Erkodent Polishing Discs *cont'd*

Lisko-S Turquoise polishing discs have a fine grain, half open stabilized structure that allows removal, rounding off, smoothing and polishing of both soft and hard materials. The ideal hand-piece speed range is 4000 - 10000 Rev/Min. I find that this disc does a great job of cleaning off any tissue tags and burs left behind after an acrylic bur adjustment. Leaving a very nice smooth and shiny finish. Of course, it also works great at establishing a final polish after using the Coarser Lisko discs discussed above.

Lisko Polishing Discs FINE White Polishing Disc Part # 223100

Lisko Polishing Discs MEDIUM Grey Polishing Disc Part # 223101

Lisko Polishing Discs COARSE Brown Polishing Disc Part # 223102

Assorted 10 Pac #223105

Erkodent: Lisko-S® Turquoise Polishing Disc Part #223200

Please wear protective eyeglasses whenever you engage in these procedures.

More Practical Pearls

Chapter 13

Enhancing Retention

Enhancing Retention

This nylon polymer is quite remarkable to say the least. ***However, tightening these appliances in cases of poor retention post fabrication requires following certain principles.*** Attempts have been made to describe tightening the appliance by heating it with a flameless torch, pinching it between your fingers and placing it in cold water to maintain the pinched shape ***(Diane Robichaud DT Panthera Dental)***. I have tried this technique on several occasions obtaining only a marginal increase in retention and never enough to actually remedy the problem. That being said, I am told that with practice this technique will allow one to reshape the appliance around a new crown! Perhaps that is possible, but clearly not easily accomplished by the ***faint-of-heart***. After all, we are talking about an expensive appliance that melts when you apply enough heat to it! So, this technique may work better for some than for others, depending on your ***intestinal fortitude***!

Another suggestion has been to add some restorative resin to the buccal of the teeth lacking retention, creating more of an undercut. A technique used in Invisalign therapy. In my mind, this poses the problem of extra cost, extra chair time and the liability of resin that can (and will) fall off. Nevertheless, many have found this technique to be a "life-saver". So, I have included a summary of this technique later in this chapter along with a picture courtesy of ***Dr. Todd Morgan of San Diego California***, who has had great success using this method.

My preferred method of enhancing retention of a nylon appliance is borrowed from the technique used to enhance retention on Essex retainers. I have found this method to be quick and reliable, allowing me to enhance retention in just a few minutes in most cases that have come up against.

More Practical Pearls

Chapter 13

Enhancing Retention

Thermoplier Technique

Lionel Dwyer, of Orthodent Dental Laboratory in Oshawa Ontario developed this protocol. Actually, it turns out that slightly revised, the technique used to increase retention in plastic retainers can also be used to increase retention in nylon sleep apnea appliances. However, before one puts a hot iron on an expensive nylon appliance I would suggest reading the protocol described below and trying the technique on a practice appliance.

This protocol utilizes the following tools: ***Hilliard Undercut Enhancing Thermoplier, Round Acrylic Burs, Miltex Calipers, Flameless Butane Torch, Digital Thermometer.***

Lionel Dwyer Bird Carving Champion, DT

Enhancing Retention

Thermoplier Technique *cont'd*

What we are talking about is increasing the depth that the nylon protrudes into the interproximal undercuts; thus increasing appliance retention. The ***Hilliard Undercut Enhancer Thermoplier*** can be used to do this in the same manner it is used on plastic retainers.

Step 1) Initial Set-up of Thermoplier: Adjust the amount of adaptation the plier will provide by adjusting the hex-screw, which allows you to set exactly how far the plier will push into the nylon. *(Once you are set up with a practice appliance you can engage the Thermopliers as described in the text below and set the hex–screw appropriately. Once set, the same depth should work fine from case to case.)*

Step 2) Visually survey the lingual and buccal of the teeth lacking retention on the patient's model, and decide which interproximal areas may be exploited to increase retention. Mark these areas with a pencil inside the appliance. The goal will be to have the marked protrusions extend further into the interproximal undercuts thus increasing retention. In the pictures to the left you will see the target retention enhancement areas marked in pencil inside the appliance and at the corresponding spot on the out side of the appliance.

Enhancing Retention

Thermoplier Technique *cont'd*

Step 3) If the interproximal area you will be enhancing is too thick, you will need to reduce this thickness with an acrylic bur on the outside of the appliance. Using the pencil mark from the previous step as a guide, reduce the nylon thickness first with a 4mm round acrylic bur, and then with a 2mm round acrylic bur to demarcate exactly where you will be placing the beak of the thermoplier to enhance retention. Avoid grinding the material thinner than 0.5mm. ***Calipers*** come in handy to ensure you don't do this. In the picture to the right you see the reduction of material by round acrylic bur in the target areas.

Please keep in mind that it is not always necessary to reduce the nylon thickness, or to reduce it to 0.5mm. On your practice model you can experiment with using the thermopliers at various levels of thickness to determine what works best in your hands. Reduction is only necessary to allow the thermopliers to engage the area properly and should be done sparingly.

Enhancing Retention

Thermoplier Technique *cont'd*

Step 4) Heat the wedge-tip of the plier for 4-5 seconds with a ***flameless butane torch***. This should bring the temperature up to around 30°C. A ***digital thermometer*** can be used to confirm that you have not overheated the plier. This nylon has a thermoforming temperature of 50-60°C. However, I find that the plier works well at about 30°C, which can be achieved with about 5 seconds of heating.
Remember, too cool and the nylon will not be modified, too hot and you may burn right through the nylon. Melting temperature for this nylon is north of 172°C (341°F); as the temperature you will be working with is far less, there should be no concern. You may be tempted to wing it but an inexpensive digital thermometer can help alleviate any concern regarding irreversibly damaging the appliance, at least while you are becoming accustomed to this technique.

Step 5) Squeeze the handles of the plier together to enhance the undercut gingival to the contact point. You may have to enhance a number of undercuts but I suggest enhancing one at a time while you are becoming accustomed to this procedure. This material returns to a non-deformable state when the temperature normalizes which takes about 4-5 seconds after applying the pliers to the nylon.

Enhancing Retention

Thermoplier Technique *cont'd*

So, first squeeze the pliers, you can observe the undercut area being enhanced inside the appliance as you squeeze, then hold the pliers in place for about 4-5 seconds while the nylon cools, then remove the pliers and check the appliance either on the patients teeth or model to determine if the retention is sufficient. If not, repeat the process at another interproximal area until retention is satisfactory. Of course, if the appliance ends up too tight, a light adjustment with an acrylic bur to the nylon that protrudes into the undercuts should relieve this.

Although these appliances are very accurately manufactured, there are a variety of reasons you may end up with insufficient retention. So far, ***this is the best technique I have seen to help resolve retention issues without the trouble and expense of a remake.*** Unlike the ***"heat and pinch"*** technique that has not worked for me after several attempts, the ***"plier trick" has worked for me on a number of occasions!***

For those cases not requiring reduction with a round acrylic bur it is has been particularly rewarding to be able to kick the retention up a notch in literally 1-2 minutes. **Thanks Lionel.**

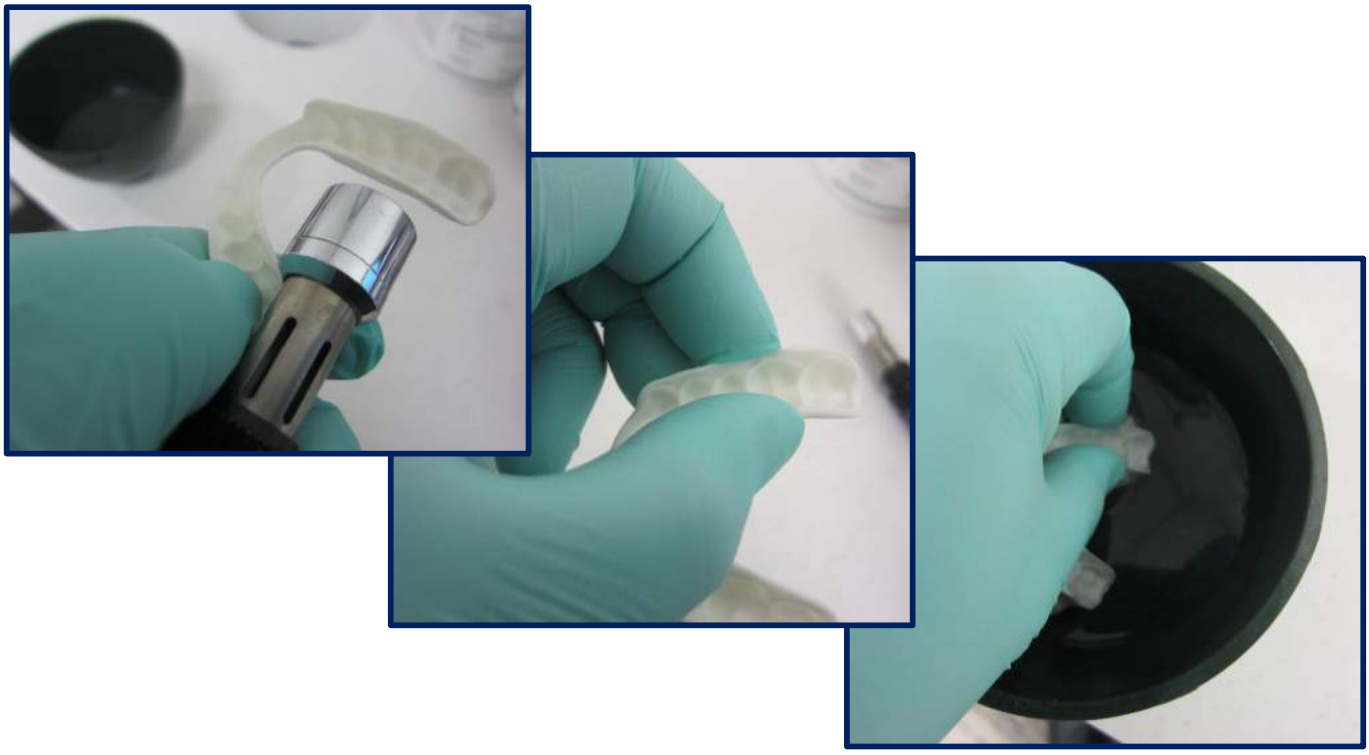
More Practical Pearls

Chapter 13

Enhancing Retention

The Squeeze Technique

Heat one side of arch, either buccal or lingual, not both. Squeeze slightly and hold in water to cool. Remove from water and try on dentition. Repeat if necessary.



More Practical Pearls

Chapter 13

Enhancing Retention

Resin Retention Button Technique

As I have already mentioned, I don't have personal experience with this technique. However, I have heard too many positive reviews of this approach to not include it as a possible remedy. The picture below is courtesy of ***Dr. Todd Morgan, San Diego California,*** which has successfully used this technique. Similar to the Thermoplier technique it is borrowed from another area in dentistry. ***It is actually a variation of the button placement technique used with Invisalign. So here goes…***

Steps for adding retention with resin button:

- ***Explain to patient why and how*** you would like to place retention buttons on certain strategic teeth.

- Selectively grind a long miso-distal divot into the ***inside of the appliance*** on the facial aspect of the teeth that require enhanced retention. (for shape see picture of Button on facial of molar above)

- ***Isolate the patient's dentition*** using a retractor (OptraGate) or Isolation device such as the Mr. Thirsty by Zirc to isolate the teeth and reduce salivary contamination.

- ***Try-in the appliance*** with the retractor in place.

- Use an air-water syringe to ***completely air-dry*** the Inside of the appliance.

- ***Acid-etch the enamel*** of the teeth in the specific shape and location of where the composite attachment will be placed, with little excess on the rest of the tooth.

Enhancing Retention

Resin Retention Button Technique *cont'd*

- ***Rinse the etched tooth/teeth*** for 15 seconds and dry until the tooth surfaces have a frosted appearance.

- ***Mix and apply the bonding agent*** to the etched surface. Scrub the area for 20 seconds to enhance the bond strength and dry with light air.

- ***Light-cure the bonding agent*** for 10 seconds.

- ***Load the shade-matched composite*** (eg. GrandioSo) into the divot you have prepared inside the appliance. Ensure the Divot is fully packed without voids. Do not to overfill or under-fill.

- ***Fully seat the appliance*** with composite loaded Divots onto the teeth.

- ***Firmly hold down the appliance*** onto the dentition and light cure through the appliance.

- ***Remove the appliance***, and then remove all flash and bonding resin between teeth. Floss interproximal areas and remove any excess resin or composite.

- Ensure the attachment ***isn't too sharp*** and ***does not interfere with the patients bite***. ***Polish*** the button as necessary.

- ***Repeat t***he procedure for ***any additional buttons***.

Enhancing Retention

Resin Retention Button Technique *cont'd*

Resin Buttons on Facial of Molars

Picture Courtesy of Dr. Todd Morgan

Dr. Todd Morgan Dentist

Enhancing Retention

Resin Retention Button Technique *cont'd*

So, it is obvious that in order to complete this procedure properly, a reasonable amount of chair time is required. However, in some jurisdictions, this procedure could be delegated to an auxiliary making it more palatable in my mind.

As already mentioned, my first choice method is use of the thermopliers and I have had great success to date with it. However, in cases where the thermoplier method falls short, I can see how the button method could save the day as it provides you even more control; it is actually enhancing the undercut available by changing the shape of the tooth rather than simply better engaging the existing undercut that is naturally available. Quite frankly, ***between these two methods, I believe that post-fabrication retention issues should be a non-issue.***

Keep in mind that in cases of inadequate retention that is established prior to fabrication, these buttons can be quickly added freehand, allowing the option of one of these Nylon appliances for the patient.

More Practical Pearls

Chapter 13

Enhancing Retention

Clinical Experience: Enhancing Retention Case Study

Patient “A” presented after 2 months of not wearing her Narval appliance stating that it no longer fits. When questioned about whether she had any dental work performed, she disclosed that she had a new crown placed on the lower right 1st molar and fillings replaced on the lower left 1st and 2nd molars. She did not bring her appliance to her Dentist when having this work completed nor did her Dentist take into consideration that she would be wearing her Sleep Apnea device over her new crown and fillings.

What to do?

After confirming with her dentist regarding which teeth were worked on I proceeded to remove nylon from the inside of the appliance so as to correct any binding that was occurring. Once the appliance fit comfortable without causing any excessive pressures on her teeth I then used the “Thermoplier Retention Enhancement” technique described in this manual. Yes, this was all time consuming, about 45 minutes, but we were able to salvage the appliance and the patient is back on track with her oral appliance therapy. Please keep in mind that this situation involved 3 very strategic teeth required for retention and we were still able to salvage the situation. Fortunately, when the treating dentist takes into consideration the fact that a sleep appliance will be worn over the new dentistry that is being placed, this process goes much smoother.

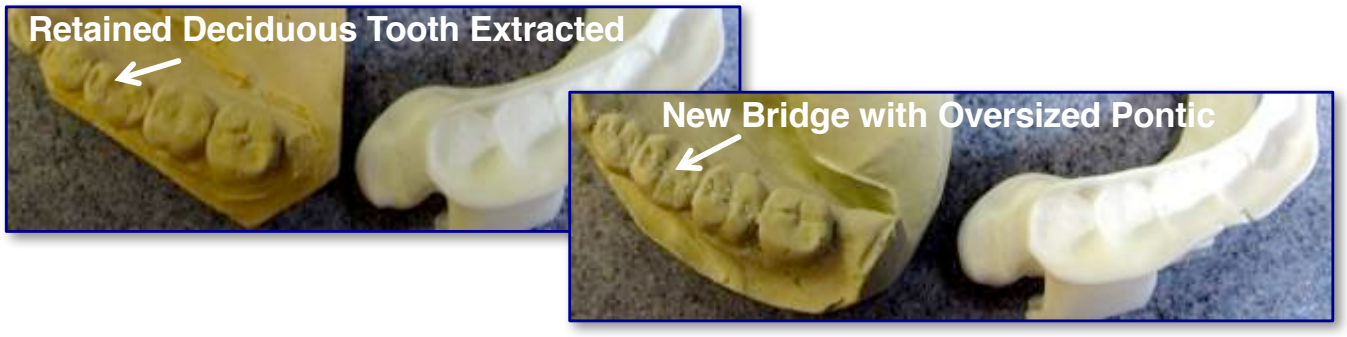
Of course, I always verbally explain to the patient the need to bring the appliance to all their Dental appointments so that the Dentist can make appropriate decisions. But, what I learned from this event was the importance of communicating with the primary dentist regarding this issue so I have added information about this to the correspondence sent to the primary dentist whenever I insert an oral appliance.

Enhancing Retention

Clinical Experience: Enhancing Retention Case Study

We were lucky that the crown and restorations were not substantially different in size than the original teeth. In another case I was not so successful in salvaging the appliance.

Patient "B" presented having had a new bridge placed in the third quadrant. Unfortunately, most of the "retention" teeth were involved in the bridge and one of the teeth went from being a retained deciduous tooth to a over sized adult tooth. The remarkable increase in bucco-lingual dimension was the problem here. After eliminating all the binding that occurred when placed over the new bridge, there was simply not enough thickness of nylon to maintain retention. As already discussed, once this nylon becomes thinner than 1 mm in thickness it becomes very flexible, making it impossible to engage an undercut with any strength. So, unfortunately for this patient, obtaining a new bridge also involved obtaining a new appliance. However, this problem could have been avoided had the treating dentist provided the lab with an impression of the original dentition and instructed them to follow the contours of the original dentition as closely as possible. I have done this successfully and had the appliance fit over the new crown and bridge with very little or no adjustment.



More Practical Pearls

Chapter 13

Enhancing Retention

Clinical Experience: Enhancing Retention Case Study

So, what we know is that we can adjust these nylon appliances to fit around new dental work including crown and bridge but certain precautions need to be taken. I recommend providing the laboratory with a model of the original dentition when making a new crown or bridge for a patient that wears a Nylon appliance. This will provide the laboratory with ample guidance regarding shape and contour of the original dentition so they can make the new crown or bridge a close approximation of the original. This would minimize chair-side adjustment time and help to ensure that the Nylon appliance could be preserved.

Since the D-SAD appliance does not contact the anterior dentition, it is typically not a concern for the D-SAD to change tooth morphology on the incisors, which is commonplace when enhancing aesthetics. However, this only applies to a Nylon appliance that is specifically made with no anterior contact.

Please keep in mind that I was able to salvage the Narval discussed above, even when a crown and restorations were placed on teeth that were strategic for retention, with absolutely no effort to preserve the original tooth shape. The price I paid was the length of time it took to adjust the Narval around the new dental work. ***So, once again, like most things in life, communication is "Key"!***

More Practical Pearls

Chapter 14

Clinical Experience Shows Us…

Tooth Movement and Band Selection (D-SAD and Narval)

Teeth move when forces are placed on them. Since wearing a Sleep Apnea oral appliance results in some level of pressure on the teeth, one can safely assume that these appliances are likely to cause tooth movement. What we are learning is that this tooth movement varies depending on appliance design and that sometimes we do have a certain level of control over that design. This is the case with Nylon appliances. When one designs the band to run over the Labial of the maxillary anteriors (which is the "Standard" default design for both the Narval CC and D-SAD), ***the tongue which moves forward along with mandibular advancement places a gentle pressure up against the Palatal of the maxillary anterior dentition. This pressure, given sufficient time, is likely to cause the anterior teeth to tilt Labially, creating interproximal spacing.*** The first patient I noticed this tooth movement on was myself. Interestingly, when I wore my Herbst appliance for a week, the diastema that had appeared between my centrals while wearing the Narval closed up completely. When I returned to wearing the Narval, the diastema reappeared.

More Practical Pearls

Chapter 14

Clinical Experience Shows Us…

Tooth Movement and Band Selection (D-SAD and Narval)

Below you see models on my dentition taken at appliance fabrication (Left) and after 24 months (Right) of wearing a Narval CC with an anterior Maxillary Band design. Visual inspection clearly demonstrates tooth movement of the maxillary incisors, However, movement of the mandibular incisors is much more subtle.

More Practical Pearls

Chapter 14

Clinical Experience Shows Us…

Tooth Movement and Band Selection (D-SAD and Narval)

I decided to have a cephalometric radiograph taken to compare my dentition to one taken in 2010. Of course, once could say that since I started wearing my Narval CC only 2 years ago some of the changes could be attributed to my previous appliance, the Dorsal. However, the reality is that both the Diastema and the posterior interproximal spacing only became noticeable to me since I started wearing the Narval CC.

Dr. John Viviano Ceph May 31, 2010

Dr. John Viviano Ceph Aug 13, 2015

Dr. Mark Eckler, and Dr. Derek Leung, both local Orthodontists (smilenow.com, Ontario Canada), were kind enough to review my pre and post Cephs and both agreed that no significant tooth movement had taken place. The only explanation for the diastema between my maxillary central incisors was labial tilting which could be explained by the subtle pressure my tongue could be applying to the palatal of these incisors on a nightly basis. My explanation for the loss of contact in some of the molar dentition is the forces placed on these teeth by the nylon gripping on the teeth inter-proximally in order to acquire the needed retention.

More Practical Pearls

Chapter 14

Clinical Experience Shows Us…

Tooth Movement and Band Selection (D-SAD and Narval)

The wife of a long-standing patient came to see me for an appliance. Her husband, who first wore a Silencer and then transitioned to a Somnodent over a 12-year period, wanted her to get a Somnodent as he was having such a good experience with it. Upon seeing the Narval, she chose it over the other offerings due to its small size. All went well regarding the management of her snoring and mild OSA, however, ***within just a few weeks of wear, she developed a diastema between her two maxillary centrals that was far from small and increasing with passage of time.*** I requested that a new appliance be made due to the patient's "complaint/side effect" and was able to have the appliance remade with a Palatal band with Incisal wrap. It took a while, perhaps 2-3 months, but ***the diastema closed completely while continuing to wear her new Narval with the Palatal band design***. Closure of the diastema required no further effort on my part aside from selecting the correct band design for this particular patient. Both the Narval and D-SAD have essentially the same anterior Band design; no contact with the dentition with various Band designs.

When selecting which band design to use on the maxilla I like to consider the starting point. ***Are the maxillary anteriors already in an ideal bite that the patient would prefer to protect? Are diastemas already present? Is there crowding that could benefit from some Labial repositioning? Are the teeth biting in an end-to-end relationship, which could also benefit from some anterior repositioning? Etc.***

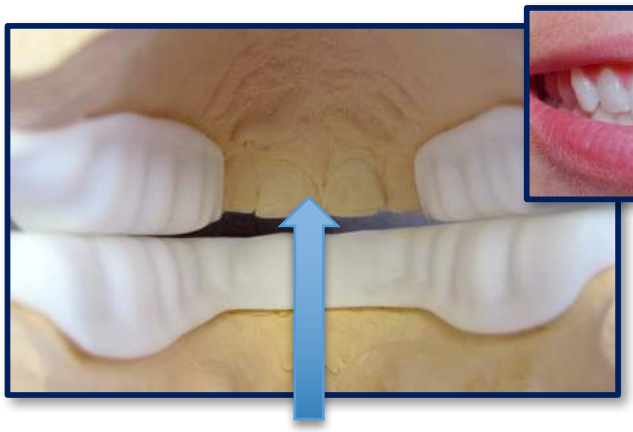
More Practical Pearls

Chapter 14

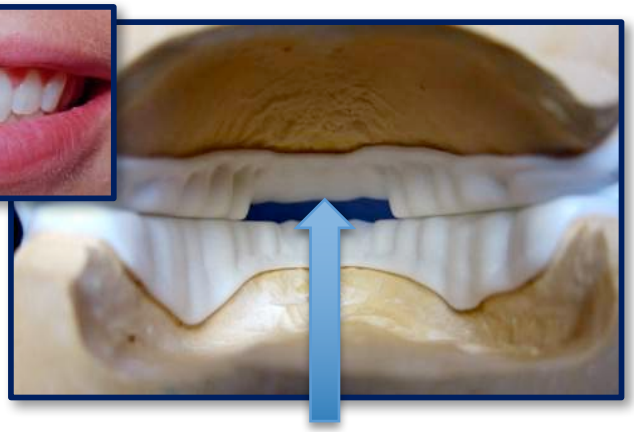
Clinical Experience Shows Us…

Tooth Movement and Band Selection (D-SAD and Narval)

If the objective is to absolutely minimize tooth movement I tend to prescribe the Palatal band with an Incisal wrap to the labial surface **.** There have been reports that some but not all patients develop the habit of rubbing up against the lower edge of the band if the palatal band "only" design is used, so wrapping the band around the incisal onto the labial provides a smooth surface for the tongue to rub up against. It's a good idea to treatment plan around this tooth movement issue before prescribing these appliances. In some cases, the tooth movement associated with the Labial band may be desirable; it's nice to have some level of control over this in our treatment planning, and it's better to manage this issue prior to ordering the appliance in the first place. ***Whatever the situation, full disclosure to the patient regarding any tooth movement you anticipate occurring is a must.***



Tongue free to push up against palatal of maxillary Incisors, tilting them labially



Lingual band protects from tongue forces

More Practical Pearls

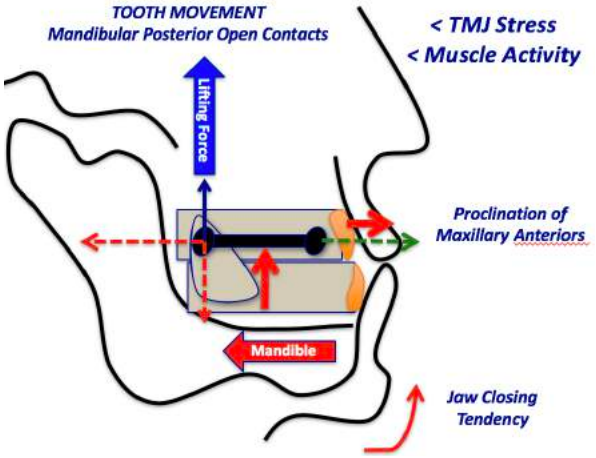
Chapter 14

Clinical Experience Shows Us…

Retention and Band Selection (D-SAD and Narval)

Initially, the Narval and D-SAD had the anterior bands run across the Labial of the upper dentition and lingual of the lower dentition solely. However, in cases of shorter teeth, lacking in undercuts for retention ***it was discovered that wrapping the band over the Incisal edge and down the other side made the appliance much stiffer.*** This allowed the retentive undercuts to be paired up from one quadrant to the other rather than depending solely on pairing them from within the same quadrant. The ability to engage undercuts from both sides of the arch substantially decreased the number of appliances being rejected for lack of retention. So, in cases where you are questioning adequacy of retention I recommend using a full coverage band, or coverage that runs over the Incisal edge to the other side. Since at the design stage the manufacturer has all the required information, I typically authorize ***them to make the best decision on this issue, full or partial wrap.***

The above applies more so to the mandibular arch than the maxillary arch. Without adequate retention, the force vectors tend to result in the posterior portion of the lower arch lifting off the dentition.



More Practical Pearls

Chapter 14

Clinical Experience Shows Us…

Irritations Caused by Connector (D-Sad and Narval)

Sometimes the patient complains about the strap connector rubbing against the inside of their cheek. In most cases, the tissues get used to the appliance's presence and the complaints stop. However, if they persist, you can use the flameless torch to heat the connector up slightly and then press on it lightly with your thumb to push it in and away from the cheek. It is best to do this while the appliance is placed on the original models to avoid any distortion from taking place to the appliance. Below are images of this procedure on a Narval CC appliance, the exact some process works on a D-SAD appliance.

More Practical Pearls

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Clinical Experience Shows Us…

Palatal Band Myo-functional Alert

There has been some discussion that the incisive papilla plays an important role in helping a patient establish proper tongue position. So, it may be a consideration to leave the incisive papilla completely unobstructed. ***Dr. Daniel Klauer of Indiana*** shares with us that he has had patients with "Old World" acrylic appliances go from having a less than optimum to a favorable outcome once he exposed the incisive papilla by grinding away the acrylic.

A request to leave the incisive papillae exposed can be included in the original prescription as a notation. Or, after the fact, this portion of the band can be ground away and polished to expose the incisive papillae using the techniques discussed in this manual.

Dr. Daniel Klauer Dentist

More Practical Pearls

Chapter 14

Clinical Experience Shows Us…

Tongue Comfort and Band Selection (D-SAD and Narval)

Dr. Les Priemer of Ontario, Canada shares the following case study with us. At a regular follow-up visit, Les had a patient that was successfully managing severe Sleep Apnea with a Somnodent appliance ask if there was anything new. His appliance was 4 years old. This gentleman is a busy CEO that travels frequently, initially, he moved on to the Somnodent after demonstrating intolerance to CPAP, this transition went smoothly, was unremarkable and the patient was so happy with the Somnodent that he arranged for a second copy for his beach house. So, we have a compliant, co-operative, dedicated patient that buys not one but two appliances.

In June 2013, Les showed him a Panthera D-SAD and the patient was sold. In December 2013 Les inserted a Panthera D-SAD. In January 2014 the patient phoned complaining about tooth pain and that his wife had issues with the whistling like sound that occurred during his sleep. In February 2014, the patient presented with a "cyst-like" lesion on his upper lip, in the area adjacent to the coupling in the 13 area and at least 5 aphthous ulcer like lesions on the tip of his tongue. The cyst-like lesion appeared to be the result of his lip being caught on the coupling in that area and the lesions on his tongue appeared to be related to him rubbing his tongue over the Incisal edges of his uncovered incisors. He was advised to discontinue using the Panthera and the tongue ulcers resolved. Panthera offered to remake the appliance with a full wrap anterior band on the mandible but the patient decided to stay with the Somnodent appliance which he had been very content with. Les noted that the cyst-like lesion on his lip was diminished but still visible the last time he saw the patient in Dec 2014.

More Practical Pearls

Chapter 14

Clinical Experience Shows Us…

Tongue Comfort and Band Selection (D-Sad and Narval)

Going forward, Les continues to make 3D printed appliances, actually, **many 3D printed appliances**. However, due to this experience he routinely opts for the mandibular anterior band style that is a full wrap. As discussed in the Band section in this manual, this full wrap design increases mandibular retention, protects the teeth from tooth movement that may occur from tongue pressures and of course protect the tongue from rubbing up against sharp and dangerous objects, like the mandibular incisors!

Regarding the lip irritation, of course every appliance has their own unique feature that has the potential to irritate soft tissue initially. Usually, this resolves with time. I think one of the take home messages here is this. If you are successfully managing a patient with a particular style appliance and they have no complaints, the safest thing to do when replacing the aged appliance is to go with the same design.

Thanks Les, for sharing this valuable lesson with us.

Dr. Les Priemer Dentist

More Practical Pearls

Chapter 14

Clinical Experience Shows Us…

Incorporating Invisalign into an OA

Dr. John Carollo of Florham Park, New Jersey describes a method for using an Invisalign retainer along with a Sleep Apnea oral appliance. When post orthodontic patients want to manage their snoring or sleep apnea with an oral appliance, retention of the orthodontic effort is often compromised. Often, fixed lingual retainer wires are used. However, when removable retainers are used, patients do not want to wear their Sleep Apnea Oral Appliances at night and their orthodontic retainers separately during the day. Fabricating a sleep appliance that can fit over a patient's orthodontic retainers enables the patient to wear both at the same time while sleeping.

Care must be taken to obtain a good impression of the patient wearing their orthodontic retainers. Using a 3D printed oral sleep appliance allows for an accurate fitting oral appliance over a patient's orthodontic retainer and simplifies their protocol for both orthodontic retention and management of obstructive sleep apnea. Below, John explains how he has used an Invisalign Vivera retainer under a D-SAD appliance for simultaneous nightly wear.

Dr. John Carollo Dentist

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Clinical Experience Shows Us…

Incorporating Invisalign into an OA

This post Orthodontic patient was diagnosed with Mild OSA and preferred to wear an Oral Appliance to CPAP. John explains that Vivera Retainers are approximately 2mm thick, and the D-SAD is between 1 and 2mm thick. The bite registration taken to fabricate the D-SAD must account for the thickness of the Vivera retainers. So, for this case, the bite was taken with a ***George Gauge from Great Lakes Orthodontics*** using their 2mm bite fork, ***with the retainers in place.*** Panthera Dental was instructed to make the D-SAD with a total of 6mm vertical opening or height and the patient was able to wear both his Sleep Apnea and Retainer appliances simultaneously at night, protecting both his airway and his dentition.

Vivera Orthodontic Retainer

Post Orthodontics

Orthodontic Retainer in situ

Orthodontic Retainer and D-SAD in situ

Mandibular Arch Pre and Post Orthodontics

More Practical Pearls

Chapter 14

Clinical Experience Shows Us…

Incorporating Invisalign into an OA

The second case study John shares with us involves using the ***Airway Metrics bite registration technique in conjunction the ECCOVISION Acoustic Pharyngometer (Sleep Group Solutions).*** I think this example helps to demonstrate the flexibility available regarding bite registration techniques with nylon appliances. The bite registration was taken with 8mm vertical and 6mm horizontal Airway Metrics Mandibular Positioning Simulator ***with the retainers in place (taking the total vertical up to 10 mm).*** Panthera Dental was instructed to make the D-SAD at the 8mm vertical and 6mm horizontal jaw position.

Airway Metrics
10mm vertical and 6mm horizontal
Mandibular Positioning Simulator
on patient's natural teeth

Airway Metrics
8mm vertical and 6mm horizontal
Mandibular Positioning Simulator
on patient's Vivera retainers

Bite Registration as per
Airway Metrics Simulator

Panthera D-SAD Constructed
To Airway Metrics Bite Specifications

More Practical Pearls

Chapter 14

Clinical Experience Shows Us…

Advancement Straps and More…

Dr. Jacques Houde of Quebec City, Canada has provided a case study that helps to demonstrate the evolution of Nylon CAD/CAM appliances.

In 2007, Jacques provided a heavy bruxing patient a hand made, Pre CAD/CAM Narval appliance. This Narval was the original Narval design manufactured in an "Old World" manner using the thermoform technique similar to the EMA appliance. The appliance was advanced to 90% of the patient's maximum protrusion, and it was found to fully manage the patient's sleep apnea and snoring. However, with time, the lower component lost retention, necessitating accentuation of the buccal profile of certain molars with resin to enhance retention and correct the problem. Another issue Jacques experienced was that the advancement straps would stretch, decreasing the effectiveness of the appliance. (Similar to what happens with the EMA appliance) Eventually, after a year and a bit, the thermoformed appliance fractured which Jacques attributed to the patient's heavy bruxing.

In 2009, Jacques fitted the patient with a Resmed Narval CC appliance made in Lyon France. This was the first generation of the CAD/CAM 3D Printer fabricated appliance. This nylon appliance stood up very well to the patient's bruxing but he found that the straps stretched and required regular replacement in order to maintain efficacy. They would become over 1mm longer after just 2-4 weeks of wear by this patient.

After ***3 years of wear***, in 2012, the anterior Band on the lower component fractured. It was determined that repeated bending during insertion of the appliance caused this.
In 2012, Jacques fitted the patient with a Panthera Anti-Snoring device now known as the D-SAD. This appliance has advancement straps made of the same type of material as the body (type 12 polyamide nylon), as a result, they did not demonstrate signs of elongation in this patient.

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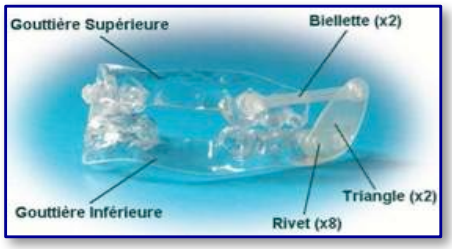
Clinical Experience Shows Us…

Advancement Straps and More…



2004: First Thermoformed Narval Appliance

2009: First Cad/Cam NARVAL Silicone Covered

In 2012, the default design of both the Narval CC and the Panthera anti-snoring device (D-SAD) had a simple anterior Band that did not wrap over the incisal of the lower anterior teeth. The Narval CC had this Band on the facial and the Panthera appliance had the Band on the lingual. Due to Jacques' special relationship with Panthera, he was able to beta test a lower Band design that wrapped over the incisal onto the labial of the mandibular teeth for this patient. The patient wore this new design for a number of years, problem free. I thank Jacques for his contribution and helping us better understand the evolution of these devices.

2012: Panthera Anti Snoring Device (D-SAD)

More Practical Pearls

Chapter 14

Clinical Experience Shows Us…

Advancement Straps and More…

The Band design Jacques speaks of (which wraps over the incisal onto the labial of the mandibular teeth) has been available to us on the D-SAD appliance since early 2014 and my understanding has been that this design was implemented predominantly because of the increase in retention it provides. Checking with ResMed, I found out that breakage of the anterior Band has been reported with the single Band design in earlier appliances but design changes have been made regarding distance of the Band from the dentition and thickness of this anterior Band and the incidence of this problem is now 0.03% of Narval CC appliances made since December 2013.

There is no reason to believe that the D-SAD appliance with a simple anterior Band (like the first generation D-SAD) would be free of the same susceptibility to breakage. Please note that this case study dates back to the very first generation of the Narval CC appliance.

Dr. Jacques Houde Dentist

More Practical Pearls

Chapter 14

Clinical Experience Shows Us…

Advancement Straps and More…

Further on the anterior Band fracture. I had a phone conversation with the inventor of the Narval CC, Ludovic Baratier. He confirmed the issue and provided some insights on how to minimize it. Of course, these insights would pertain to either the Narval CC or the D-SAD appliances. He recommends:

- ***When trying to skirt around a Frenum by grinding away Nylon, make sure not to reduce the Nylon too much, make a smooth, rounded reduction rather than a "V" shaped reduction, as the rounded reduction will be less prone to tearing.***

- ***When removing the appliance from the dentition, place fingers under the appliance and push up (or down on the top component) evenly and simultaneously on both sides.***

- ***Do not pull from the Band or Strap components when removing appliance.***

- ***Do not remove appliance on one side and then pull off the other side causing torque on the anterior Band (in cases of unbalanced retention, one side has the tendency of popping off easier on removal, pulling and placing torque on the anterior Band to remove the other side can lead to breakage.***

- ***Do not place the device in a container that compresses it or stretches it (eg. Storage box that the appliance does not sit in strain free). Doing this daily can lead to fatigue and breakage of the anterior strap.***

Clinical Experience Shows Us…

Advancement Straps and More…

Side Note:

The history of Nylon appliances includes an evolution in design features. These CAD/CAM Nylon appliances, like all appliances are a work in progress. They have been on a journey of improvement since day one and that is one of the benefits of this New World technology, the ease with which issues can be dealt with as opposed to the old world technologies, when correcting deficiencies means throwing out all your dies and casts and starting from square one.

As explained in the “Advancement Straps” section above, making these straps out of the same material as the body did not turn out to be as problem free as this clinical case study suggests. Due to the need for a fuse, making the straps stiffer only transferred the stresses to the attachment nubs, necessitating the development of nubs of increasing durability to accommodate heavy bruxers. Of course, as soon as ResMed made their straps stronger so that they would not elongate, they ended up with the same problem the Panthera device experienced (see “Attachment Straps” above). As usual, two steps forward, one step back. Regardless, this problem exists in a small subset of patients and strategies to deal with this issue are discussed above.

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Clinical Experience Shows Us…

Narval Advancement Straps

Since it is well documented that the original Narval advancement strap stretches with time. For patients that complain of a decline in appliance effectiveness at follow up visits, where you would normally consider further advancement, I would recommend checking the strap being used up against a new strap of the same size to confirm whether it has elongated. The decline in effectiveness may in fact be from not being as advanced as you would like, due to strap elongation rather than due to the patient actually needing further advancement. Remember, when it comes to advancement, the rule is ***"as much as required but as little as possible".*** So, advancing the patient further than they need to be potentially increases side effects with no benefit to the patient. Below is a picture of an "Original" Narval Strap #26 that was worn for 6 months, beside a new "Original" Narval Strap #26. If this patient were to complain about snoring at his follow-up appointment, without checking for possible elongation, the instinct would be to advance the patient to the next shortest strap, when all they would actually need is a new #26 strap.

Of course, this level of elongation is not documented with the new beefier Narval strap, see picture below of 6-month old "New Generation" Narval Strap #29 beside a new "New Generation" Narval.

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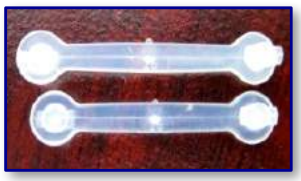
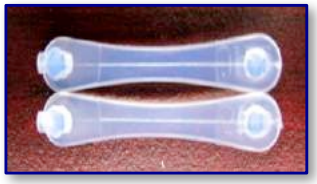


Elongation noted after 6 months of Wear with "Original" Narval Advancement strap



No Elongation noted after 6 months of Wear with "New Generation" Narval Advancement strap

More Practical Pearls

Chapter 14

Clinical Experience Shows Us…

Adjusting Vertical (D-SAD and Narval)

Both the Narval CC and the D-SAD can be made to any vertical you capture with your bite registration. So, you are free to use any favored bite registration technique that captures the vertical you wish. However, adjusting vertical after the fact has its limitations. If you want to reduce the vertical, that is easily accomplished with an acrylic bur and the polishing techniques discussed in this manual. Of course, if you have constructed the appliance to a minimum vertical, there is not much to reduce and you don't want to make the nylon thinner than 1 mm in thickness over any large area. It's increasing the vertical that is an issue.

The only commercially available aide for increasing vertical on a Nylon appliance is the "V-Tab". ***Dr. Todd Morgan of San Diego, California*** has developed these tabs, which have been approved by ResMed for use on the Narval CC. They come in 1, 2 and 3 mm thicknesses and can be placed on top of each other to establish a number of different verticals. These Tabs are available from ***"True Function Lab", 7851 University Ave Suite 101 La Mesa, CA, 91942. Ask for Frank. Phone: 619 466 1872 Toll Free: 877 887 8522.*** Although they were originally developed for the Narval CC, there is a slightly different shaped version that works with the Panthera, which has advised me that they are OK with using these Tabs on the D-SAD.

V-Tabs: or increasing vertical on Nylon appliances

Dr. Todd Morgan Dentist

More Practical Pearls

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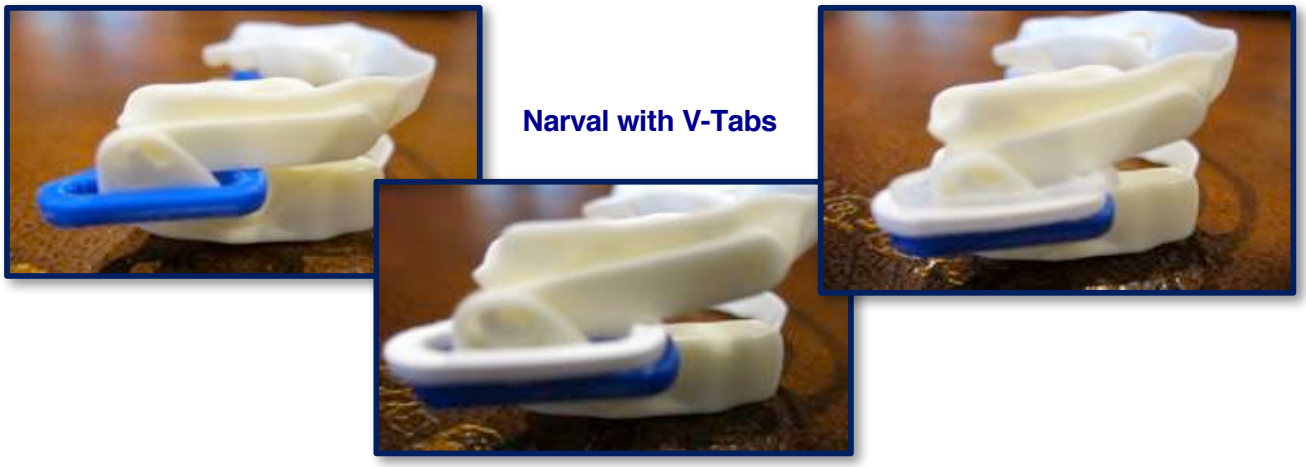
Clinical Experience Shows Us…

Adjusting Vertical (D-SAD and Narval)



Narval with V-Tabs

D-SAD with V-Tabs

More Practical Pearls

Chapter 14

Clinical Experience Shows Us…

Elastics to Maintain Mouth Closure (D-SAD and Narval)

Even though the traction advancement design of the Narval CC and D-SAD encourage mouth closure rather than the mouth opening, a subset of patients still experience mouth opening while sleeping supine with these appliances in place. For these patients, placement of elastics as depicted below will help hold the jaw up and prevent it from dropping open during sleep.

For both appliances I routinely instruct the lab place the elastic grooves on all of my appliances so that in the event they are needed, the grooves are already in place. If they are never used they do not compromise the appliance in any way.

On occasion, I find that patients prefer to sleep supine, sometimes because other problems restrict them to this position, even though it may not be the best position for their airway. Recently, I made a Narval CC for an Emergency Room Physician that was adequately treated with CPAP but was looking for the convenience of an oral appliance. She slept supine 100% of the time and had an RDI of 33.6. Even, when fully advanced, she felt that the Narval did not provide her with the same level of feeling rested that she was accustomed to with CPAP. I placed elastics on the Narval as pictured below and she claimed immediate improvement. Her follow-up study demonstrated an RDI of 5.1. She was very happy and even brought the staff chocolates!

Elastic in place held by advancement strap & grooves cut into lower component

More Practical Pearls

Chapter 14

Clinical Experience Shows Us…

Making Crown Under Appliance

So, your patient presents needing a new crown placement just a few months after placing a new Nylon appliance. What now?

- Only a problem if you are dramatically changing shape of tooth
- With reduction, the nylon loses its stiffness (becomes more pliable)
    - Try and keep to existing shape
    - If you plan on preparing a crown, send lab impression of existing tooth before preparation and tell to replicate shape as closely as possible.
        - Minor adjustments with acrylic bur are OK
        - Can enhance retention with Hilliard Thermoplier
- Of course, not a problem at all for anterior U & L Incisors since no contact
- OR, can take an impression of inside of Nylon appliance and instruct lab to replicate shape of old crown (see below)

More Practical Pearls

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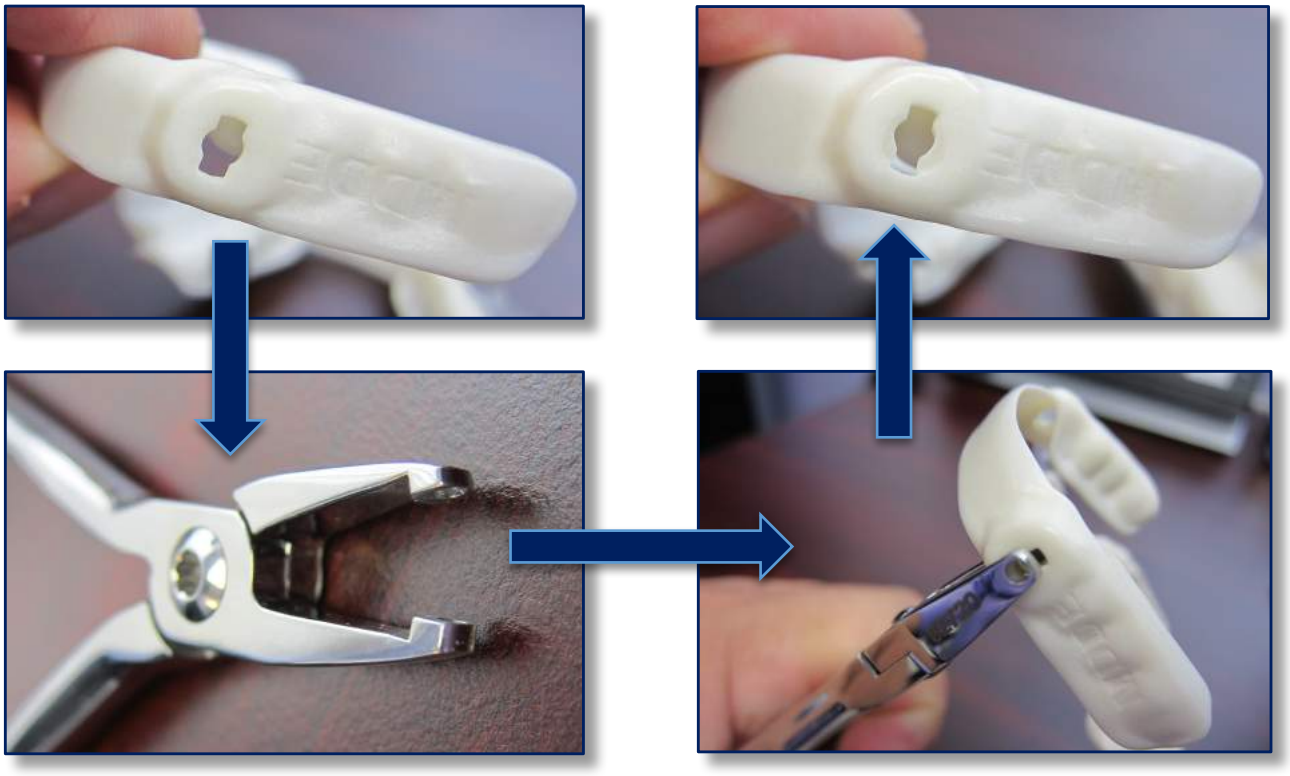
Clinical Experience Shows Us…

Narval Strap Pulling Out?



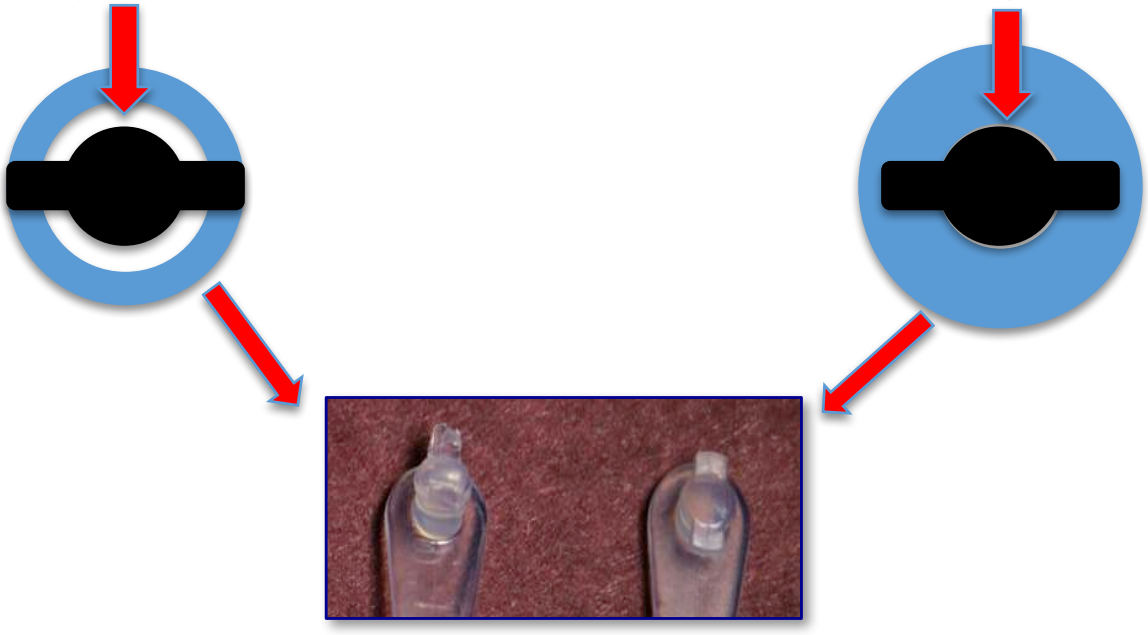
Squeezing the Nylon where the strap engages spreads the Nylon and makes the loose hole tighten up and the strap less likely to disengage. ***(See Next Page)***

Clinical Experience Shows Us…

Narval Strap Pulling Out? Cont'd

The closer you get to the end of the nylon nub the more likely it is to bend

Strongest point of nylon nub is where it attaches to the center piece



Squeezing the Nylon where the strap engages spreads the Nylon and makes the loose hole tighten up and the strap less likely to disengage. ***(See Next Page)***

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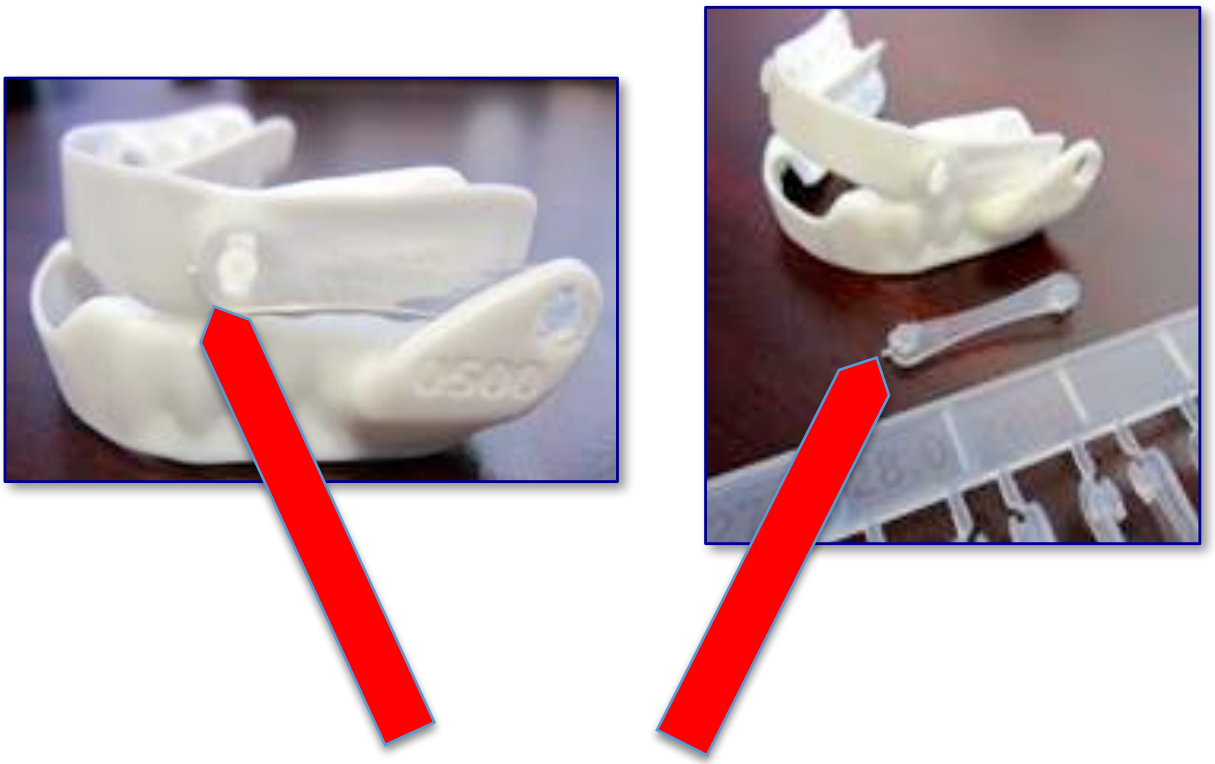
Clinical Experience Shows Us…

Narval Strap Source of Irritation



Smoothen out residual nylon on advancement strap
May irritate some patients

More Practical Pearls

Chapter 15

Collection of Pearls from Contributors

Dr. Les Priemer Toronto Ontario

- Nylon advancement straps gradually wear and start popping off. I place new straps at annual appointments; good motivation to get patients to return for regular follow up.
- “B” and “b” straps work well for bruxing patients. (D-SAD).
- I always order inter-arch elastic notches in case patient needs them.
- If there are concerns about retention due to short teeth or appliance design with short advancement straps, I opt for full coverage of the incisors.
- When adjusting nylon internally, a good way to remove the excess "feathers" is to use a Clappison amalgam carver.
- Panthera suggests Novadent as a cleaner. Nylon appliances really stain and Novadent does a great job of getting stain off and disinfecting. Not available in drug stores? Order it in bulk from the manufacturer and dispense it to your patients. At follow-up appointments, I give them a packet to remind them how good it is.
- AM Aligners are great for preventing occlusal changes but trim them so the posterior teeth aren't covered and have the patient bite into a Mylar strip or Shimstock while it is hardening. That way the patient is ensured that it is reinforcing the proper occlusion.

More Practical Pearls

Chapter 16

CAD/CAM Acrylic Appliances: How it all Began

The Prosomnus Story:
When Technology, Enthusiasm and Creativity Intersect!

While in the San Francisco area a short while ago, I arranged to visit the new ProSomnus facility in Pleasanton California. After meeting and speaking to the folks that run the show, all I can say is, ***"Very Passionate and Impressive Visionaries".*** The story I heard was fascinating, and it truly helps to explain how the Micro2 has become such a highly respected snoring and OSA appliance in such a short period of time.

Len Liptak *(Co-Inventor/Co-Foundor & CEO),* **Sung Kim** *(Co-Founder & VP of Engineering and Operations)* and **Dave Kuhns** *(Co-Founder & VP of Technology)* first met at 3M circa 2006 while working on a Digital Orthodontic Program that utilized CAD/CAM technology. The 3M company has been responsible for many novel ideas that we use on a daily basis, and the innovative 3M environment has well established itself as an excellent training ground for identifying new product opportunities.

In 2011, Len's focus was the application of a Digital Scanner (3M True Definition Scanner) for use in orthodontics. He recognized the dental lab's role in supporting dental scanners, and jumped on the opportunity to work with Microdental Laboratories, which was interested in the implementation of Digital Dental Scanners to provide an entire new level of service to dentists. ***He joined Microdental Laboratories that year, and looked for unique opportunities to meet unmet needs by implementing this New World digital technology.***

More Practical Pearls

Chapter 16

CAD/CAM Acrylic Appliances: How it all Began

The Prosomnus Story:

When Technology, Enthusiasm and Creativity Intersect! Cont'd

Once at Microdental, Len sought feed-back from dentists. He kept hearing about **"Dental Sleep Medicine"** and a meaningful trend became apparent to Len by 2012. He learned that these appliances generally moved the mandible down and forward and demonstrated good long term outcomes regarding compliance and reduction in snoring and apnea. He quickly concluded that investing his time in OSA appliances was a good idea. He also heard that these appliances are associated with tooth movement, jaw discomfort, have technique sensitive and lengthy production methods, and once delivered, required a number of adjustment appointments, further adding to the treatment timeline. ***Len noticed a number of areas that could be improved utilizing digital technology, and decided to seize the day!***

This is where the 3M background Len, Sung and Dave shared comes in, they looked at the dentist feedback, established areas that could be improved, and developed the Micro2 by considering the ***"Needs of the Customer".*** The input data provided by dentists, and the literature, was utilized to create the Micro2, with the objective of improving both the Clinician and Patient experience. Of course, one of the important criteria was patient acceptance (as opposed to CPAP), ie. it had to be something people would wear; attractive.

Creation of the Micro2 was not an easy task, input from doctors was competing; make it smaller but make it stronger, increase retention but don't use ball clasps, etc. Sung quickly realized that the only way this could be done was by using different technologies than had been used to date, and implementing a forward engineering approach. Ie. ***he utilized Complex Technology to create a Simple Device!***

CAD/CAM Acrylic Appliances: How it all Began

The Prosomnus Story:
When Technology, Enthusiasm and Creativity Intersect! Cont'd

Enter the Forward Engineering Concept: The application of software engineering principles, concepts, and methods to re-create something that already exists. In most cases, this process does not simply create a modern equivalent, but rather, it extends the capabilities of the original.

Through forward engineering, ***the Micro2 uses a standardized process that results in a consistent appliance***. Wings and flat plane are all placed in a consistent position; when hand-made, technicians are eyeballing the placement of these features. This explains why the different components continue to fit together with each level of advancement. Because of this, the clinician can simply focus on the patient's needs, rather than dealing with the variance associated with a hand-made approach to appliance manufacturing.

The ProSomnus Claim: by eliminating the noise associated with hand-made appliances, a forward engineered CAD/CAM appliance results in a more accurate appliance, and a better patient experience that facilitates reaching an end point more efficiently.

In August 2014, the Micro2 CAD/CAM Milled Acrylic Appliance which sported a unique dual 90-degree post was introduced. The very first Milled Snoring and Sleep Apnea appliance. It was developed from a Patient Centric perspective, emphasizing Ease of Use that is Patient Friendly, and a Medical Device Company manufacturing approach, rather than a Dental Laboratory manufacturing approach. The overall goal was to obtain consistent, repeatable, results that are scalable without compromise to quality,

CAD/CAM Acrylic Appliances: How it all Began

The Prosomnus Story:

When Technology, Enthusiasm and Creativity Intersect! Cont'd

and with elimination of as much of the variability associated with human error as possible. In an attempt to minimize forces on dentition, it's design utilized natural anatomy to capture retention as opposed to adding clasps.

The Micro2 was quickly embraced by dentists and the feedback and requests rolled in. This is where the benefits of CAD/CAM technology truly shines. Open Anterior, Anterior Midpoint Discluding Stop, Full Lingual Coverage, Minimal Lingual Coverage, Daytime Appliance, Increased Lateral Movement, Increased Protrusive Adjustability etc. etc. have all turned out to be NO PROBLEM for this attentive and innovative company. In just a few short years, the ProSomnus folks have progressed from a simple idea, to a company that offers a variety of appliance forms, all based on the same basic principle of manufacturing a Medical Device with Consistent Quality. ***The Micro2 is a well thought out snoring and OSA appliance worthy of your consideration.***

Since this journey began, a number of offerings using the CAD/CAM Acrylic Milled Appliance approach have entered the market. ***Expect more!*** *This approach has many of the same benefits associated with the Printed Nylon appliances.* ***I am reaching out to those clinicians that have entered this arena and amassed some clinical experience with milled acrylic appliances. Consider sending me "Case Studies" and / or "Pearls" to add to this section of the More Practical Pearls eBook. With the rate of progress in this area, I expect the next update to this eBook to be Spring of 2019. Please consider contributing. As always, contributors are acknowledged by name and photo!***

More Practical Pearls

Chapter 17

Benefits of Milled PMMA CAD/CAM Appliances

CAD CAM Design: ***Allows Quick Innovation & Development***

Milled Acrylic: PMMA: Polymethyl Methacrylate

- **PMMA** Cold cured under controlled conditions
  - Stronger, less porous, Leaches fewer monomers
  - More biocompatible
- Precision-milling production process, clasps rarely needed

Small yet strong, precise, and predictable.

- Digital storage of patient records, allows additional or replacement devices without taking new impressions

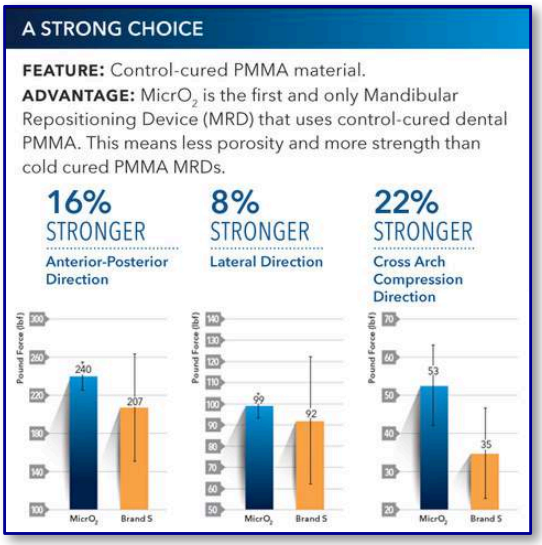
3 Year Warranties

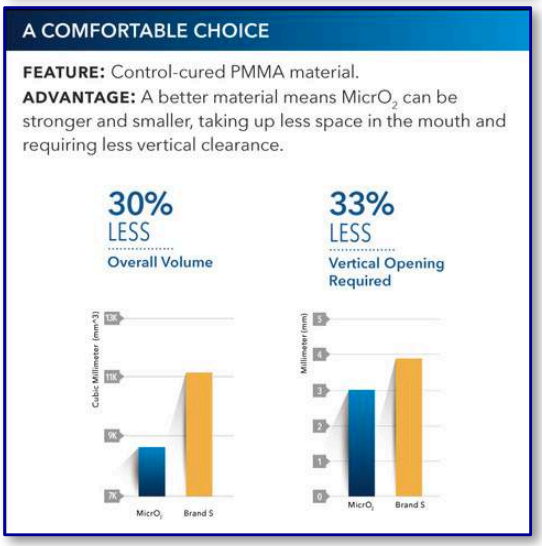
Micro2: 3 Years
OptiSleep: 3 Years
Dorsal/Herbst: 3 Years

More Practical Pearls

Chapter 17

Benefits of Milled PMMA CAD/CAM Appliances





PMMA Denser Stronger Acrylic

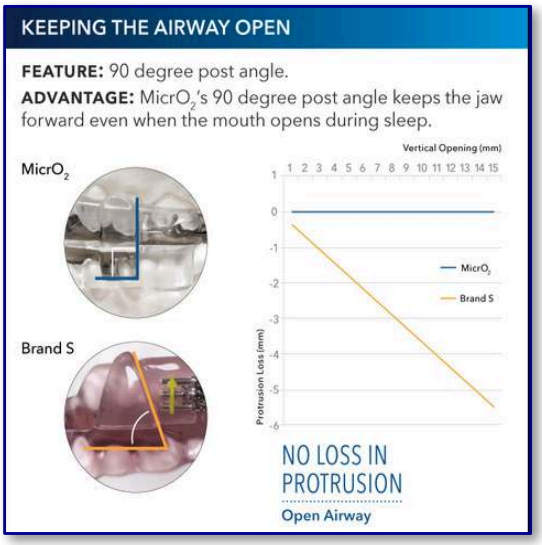
Smaller Footprint Contoured Lip & Cheek Borders

Prosomnus Studies Comparing the Micro2 to a Somnodent made for the same patient

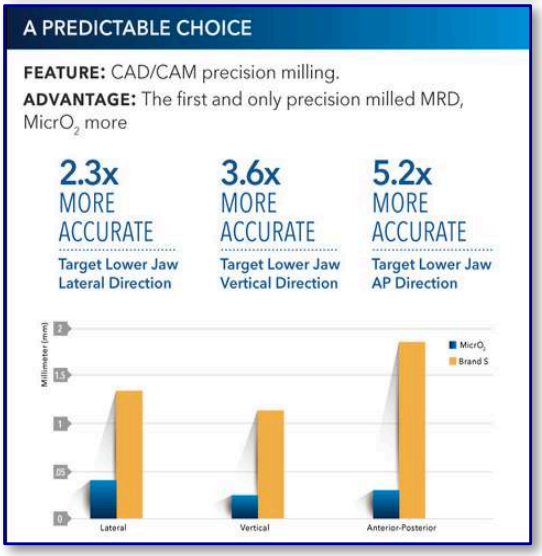
More Practical Pearls

Chapter 17

Benefits of Milled PMMA CAD/CAM Appliances



Mechanism Free 90◦ Angle Posts



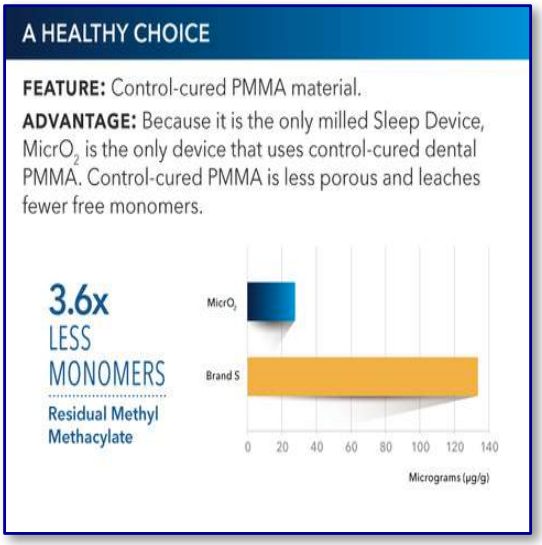
Digital Precision

Prosomnus Studies Comparing the Micro2 to a Somnodent made for the same patient

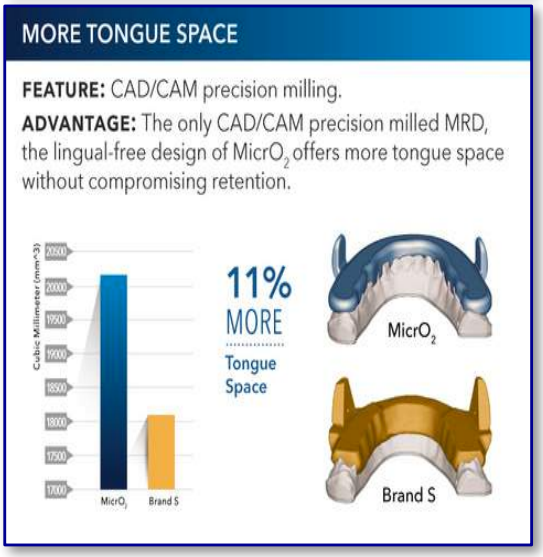
More Practical Pearls

Chapter 17

Benefits of Milled PMMA CAD/CAM Appliances



PMMA Less Porous, Leaches fewer monomers



Lingual Free Design

Prosomnus Studies Comparing the Micro2 to a Somnodent made for the same patient

More Practical Pearls

Chapter 18

Prosomnus Micro2

Micro2 Features:

- First CAD/CAM-milled OSA device
- Precision-milling production process, clasps rarely needed
- Small yet strong, precise, and predictable
- Polymethyl Methacrylate (PMMA)
    - Cold cured under controlled conditions
    - Stronger, less porous
    - Leaches fewer monomers
    - More Biocompatible / Hygienic
- Three-Year Warranty
- Seven-Day in Lab Time
- Digital storage of patient records, allows additional or replacement devices without taking new impressions

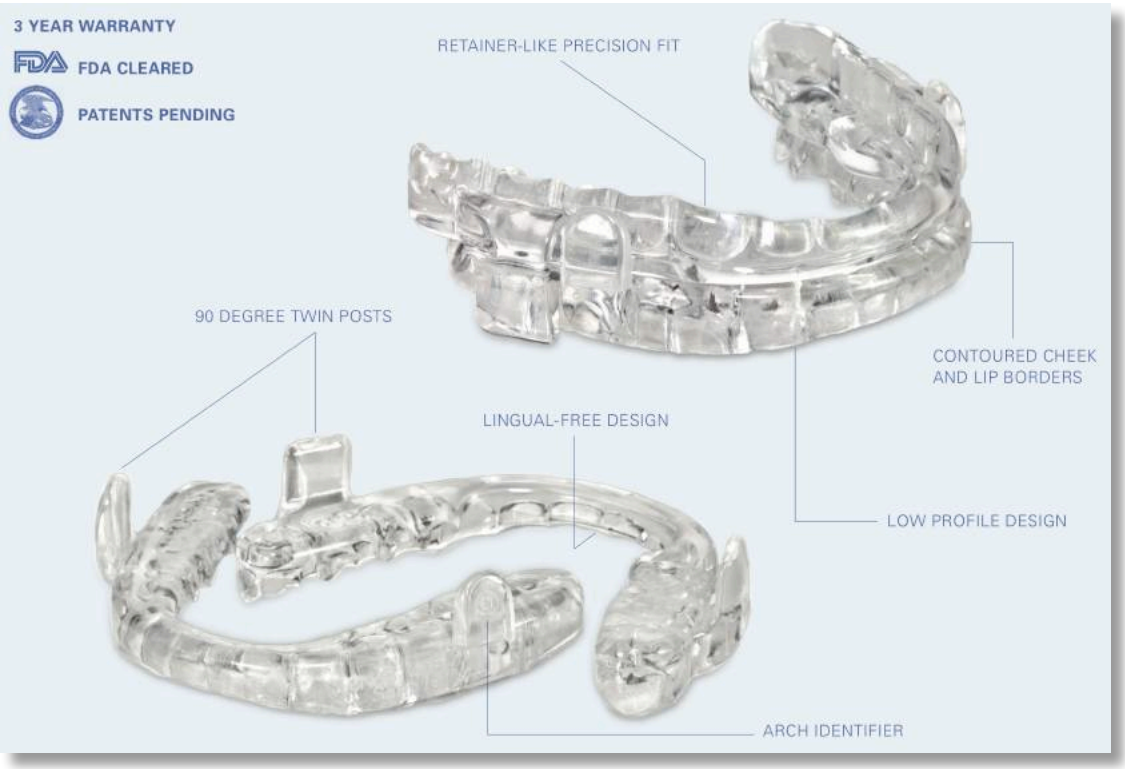
Milling Machine

Cold Cured PMMA

Prosomnus Micro2

Micro2 Features: Cont'd

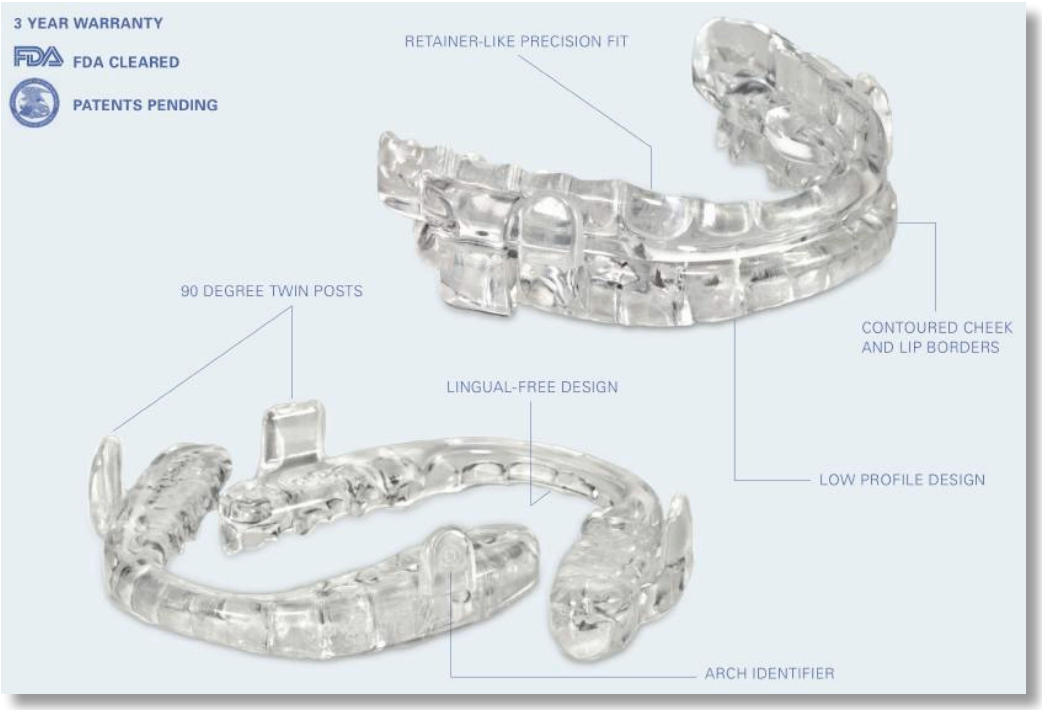
When compared to a similarly designed hand-made acrylic appliance, the Micro2 is measurably stronger, considerably smaller, fits more accurately, leaches less monomers, and provides more tongue space. It's novel 90 degree post angle helps maintain the jaw forward position when the jaw opens during sleep.



Prosomnus Micro2

Micro2 Features: Cont'd

The initial appliance offering involved multiple upper and lower arches that advanced the jaw by matching upper and lower units appropriately. Unfortunately, the range of advancement was limited unless one ordered many arches, making it difficult to know exactly where to take the initial bite registration. This initial appliance was well suited to be used when replacing an existing appliance or with the MATRx or Apnea Guard where optimum jaw position could be established prior to appliance manufacture. Prosomnus then introduced the **Iterative Advancement (IA)** version which allowed for unlimited arches to facilitate reaching an endpoint for patients requiring more advancement than originally anticipated.



More Practical Pearls

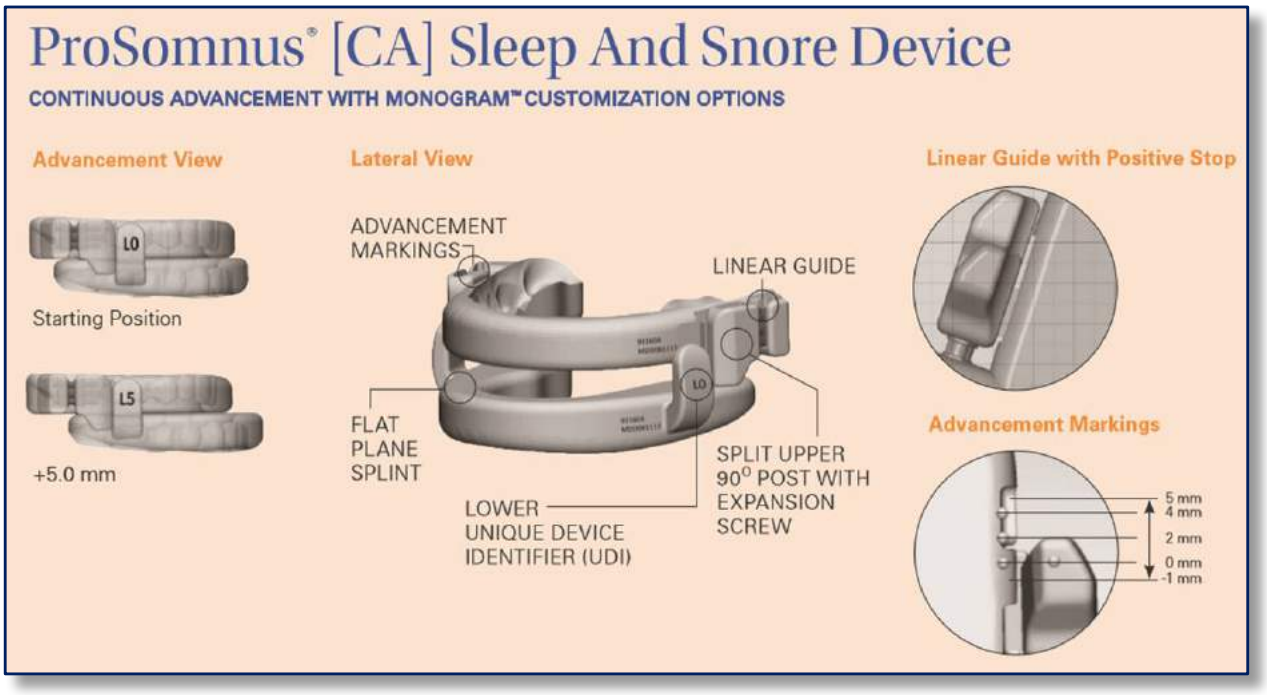
Chapter 18

Prosomnus Micro2

Micro2 Features: Cont'd

Continued requests for smaller advancement increments from clinicians, resulted in the **Continuous Advancement (CA)** version that allows for 11mm of advancement in 0.1 mm increments. ***(See Below)***

The Micro2 device is a perfect example of how quickly the CAD/CAM environment can allow an appliance to evolve based on end-user feedback. Prosomnus now offers many different appliances to be used during both sleep and wakefulness, all based on clinician feedback. ***(See Following Page)***



Prosomnus Micro2

Micro2 Features: Cont'd

The ProSomnus **ACG System** combines both day and night treatment of airway issues for a comprehensive approach to Airway Centric Dentistry.

ProSomnus® ACG Day Splint is a lower repositioning appliance that covers the canines and establishes canine guidance while opening the airway during the day. This metal-free splint involves no clasps and is thinner lingually allowing better speech which is essential for a daytime appliance. The lingual ribbon of this precision splint prevents intrusion of the teeth by covering the canines.

ProSomnus® ACG Day Full Splint is indicated for patients with an anterior open bite. This lower fuller coverage repositioning appliance establishes anterior contact, anterior guidance and opens the airway. It transfers the bite force from the posterior teeth to the anterior teeth which in a Class III lever system relaxes the masticatory muscles.

ProSomnus® ACG Functional Splint is designed as the final transitional splint within the treatment process. The patient wears this daytime splint and a night time sleep device. This anatomical splint allows the patient to eat, drink, speak and function normally for everyday life. This confirms the programming and final restorative treatment position with comfort.

ProSomnus® ACG Night Splint is indicated in individuals presenting with TMJ complaints prior to using a ProSomnus® [IA] or ProSomnus® [IA] ACG HERS Sleep Device. The ACG Night is an anti-retrusion appliance which opens the airway. The anterior guide ramp prevents the jaw from retruding. It utilizes the same repositioning bite as the ACG Day, or a slightly increased vertical and protrusive bite.

Prosomnus Micro2

Micro2 Features: Cont'd

The ProSomnus **ACG System** combines both day and night treatment of airway issues for a comprehensive approach to Airway Centric Dentistry.

ProSomnus® ACG Night Splint (with Punch Out) was added to the system in response to three occasional issues; discomfort of the lower anterior teeth in the morning following night time clenching against the anti-retrusion ramp, mobility of the lower anterior teeth with short conical roots following trauma against the anti-retrusion ramp or shifting and crowding of the lower anterior teeth.

ProSomnus® ACG BruxPad is a Protective Airway Device developed in response to the Position Paper from the American College of Prosthodontics on Oral Appliances for Sleep Disordered Breathing. This appliance is an option for the restorative dentist to manage bruxism without closing the airway. A small lingual bump guides the jaw into a neutral position avoiding retrusion of the mandible and closure of the airway.

ProSomnus® [IA] ACG HERS Sleep and Snore Device was designed for women with smaller mouths and large tongues who cannot tolerate other sleep and airway appliances. Lip seal is accomplished by thinning the labial surfaces and decreasing vertical dimension. The lingualess design also enhances treatment efficacy.

Prosomnus Micro2

Micro2 Features: Cont'd

IA (Iterative Advancement) Appliance Options

Please select either "Standard" or "Monogram™ Options"

❑ ProSomnus [IA] Standard
Includes: Lingualess Anterior Coverage; Dual 90 Degree Radius Posts; Full Posterior Coverage; Flat Plane Splint Design; ProSomnus [UA] Unlimited Advancement Arches.

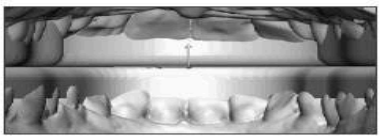
Monogram™ Customization Options
Includes: ProSomnus [IA] Standard features, plus any Monogram Customization features you select below.

COVERAGE
❍ Full Lingualess
❍ Full Lingual Coverage

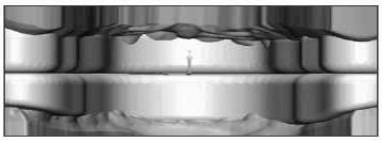
POST TYPES
❍ Dual 70 Degree Radius Posts
❍ Dual 90 Degree Non-Radius Posts

OTHER FEATURES
❍ Anterior Airway (2 mm default)
❍ Anterior Discluder (4 mm default)
❍ Metal-Free Hooks

FULL LINGUALESS



FULL LINGUAL COVERAGE



DUAL 70 DEGREE RADIUS POSTS

DUAL 90 DEGREE NON-RADIUS POSTS

ANTERIOR AIRWAY

ANTERIOR DISCLUDER

METAL-FREE HOOKS

Prosomnus Micro2

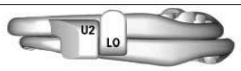
Micro2 Features: Cont'd

IA (Iterative Advancement) Appliance Options

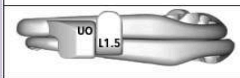
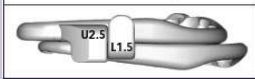
Please select your desired Series:

- ❑ Series A Advancements 0.0, 1.0, 2.0, 3.0 (mm), [UA] Unlimited Advancement
  (Default Series if no selection is made)
- ❑ Series B Advancements 0.0, 1.5, 2.5, 4.0 (mm), [UA] Unlimited Advancement

SERIES A: Range = 3 mm

4 DEVICES U0, U2, L0, L1	COMBINATION	ADVANCEMENTS
	Upper 0 + Lower 0	0 mm
	Upper 0 + Lower 1	1 mm
	Upper 2 + Lower 0	2 mm
	Upper 2 + Lower 1	3 mm

SERIES B: Range = 4 mm

4 DEVICES U0, U2.5, L0, L1.5	COMBINATION	ADVANCEMENTS
	Upper 0 + Lower 0	0 mm
	Upper 0 + Lower 1.5	1.5 mm
	Upper 2.5 + Lower 0	2.5 mm
	Upper 2.5 + Lower 1.5	4 mm

Prosomnus Micro2

Micro2 Features: Cont'd

IA (Iterative Advancement) Appliance Options

Micro2 with Braebon DentiTrac Monitor

- DentiTrac® Compliance Sensor Series Advancements 0.0, 1.0, 2.0 (mm), [UA] Unlimited Advancement

DENTITRAC® COMPLIANCE SENSOR SERIES:
Range = 2 mm

4 DEVICES U0, U1, U2, L0*	COMBINATION	ADVANCEMENTS
	Upper 0 + Lower 0*	0 mm
	Upper 1 + Lower 0*	1 mm
	Upper 2 + Lower 0*	2 mm

*L0 includes the DentiTrac Compliance Sensor Additional fee applies for DentiTrac Compliance Sensor.

Prosomnus Micro2

Micro2 Features: Cont'd

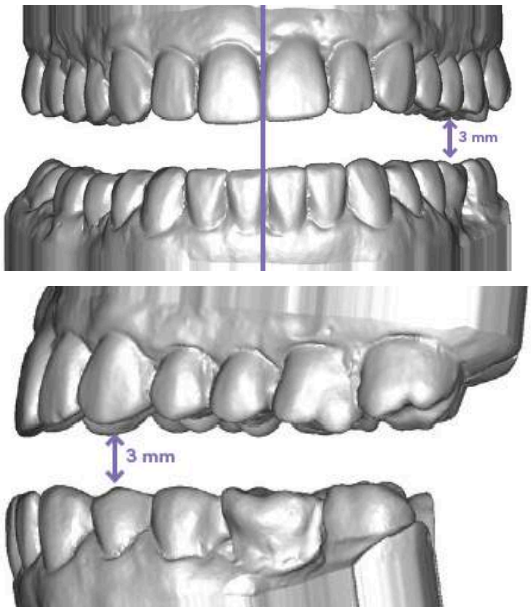
IA (Iterative Advancement) Appliance Options

ProSomnus [IA] Sleep and Snore Device Preferences Include:

- ❑ OK to adjust or close bite up to +/- 1 mm, call if >1 mm is needed.
- ❑ Digital records OK; do not send back models.
- ❑ Always reduce vertical up to 1 mm if possible.
- ❑ Add lateral play for dual posts _____ mm
- ❑ Add reinforcement for dual posts _____ mm
- ❑ Add reinforcement for anterior: ❍ Lingual ❍ Facial ❍ Both

ProSomnus® Device Bite Requirement

ProSomnus devices require 3 mm of interarch clearance. The diagram below shows how to visualize the amount of space required.



Prosomnus Micro2

Micro2 Features: Cont'd

CA (Continuous Advancement) Appliance Options

Please select either "Standard" or "Monogram™ Options"

❑ ProSomnus [CA] Standard
Includes: 1 Upper [CA] Arch; 1 Lower (L0) Arch; Lingualess Anterior Coverage; Dual 90 Degree Radius Posts; Full Posterior Coverage; Flat Plane Splint Design.
(Default series if no seletion is made.)
(Default advancement set at bite when delivered.)

Monogram™ Customization Options
Includes: ProSomnus [CA] Standard features, plus any Monogram Customization features you select below.

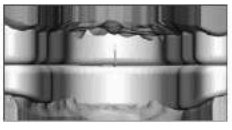
COVERAGE
❍ Full Lingualess
❍ Full Lingual Coverage

OTHER FEATURES
❍ Anterior Airway (2 mm default)
❍ Anterior Discluder (4 mm default)
❍ Metal-Free Hooks
❍ DentiTrac® Compliance Sensor* (Lower Arch)

*Additional fee applies.

FULL LINGUALESS

FULL LINGUAL COVERAGE



ANTERIOR AIRWAY

ANTERIOR DISCLUDER

METAL-FREE HOOKS

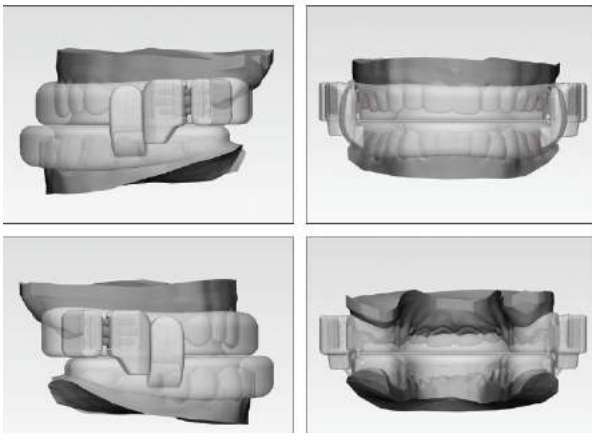
DENTITRAC® COMPLIANCE SENSOR

Prosomnus Micro2

Micro2 Features: Cont'd

CA (Continuous Advancement) Appliance Options

ProSomnus® [CA] Standard



ProSomnus® [CA] Advancement Guide

(ADVANCEMENT OPTIONS NOT TO SCALE)

PROSOMNUS [CA] STANDARD	COMBINATION	ADVANCEMENT
	Upper [CA] Arch + Lower 0 Arch	Range up to 5 mm
EXTENDED LOWER ADVANCEMENT ARCH	**COMBINATION**	**ADVANCEMENT**
	Upper [CA] Arch + Lower +5.0 mm Arch	Range up to 11 mm

Optional Arch(es)

- ❑ Extended Lower Advancement Arch
  - ❍ 5 mm
- ❑ Upper [IA] Conversion Arch*
  - Left Side_____ mm
  - Right Side_____ mm
- ❑ Replacement [CA] Arch*
- ❑ Second ProSomnus [CA] Device*

Prosomnus Micro2

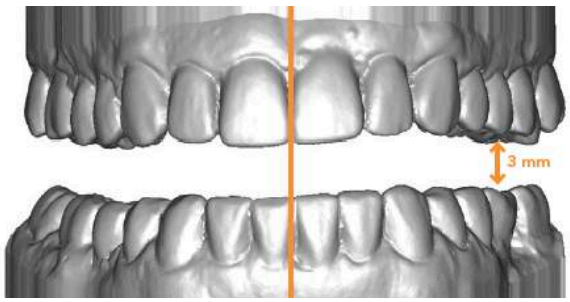
Micro2 Features: Cont'd

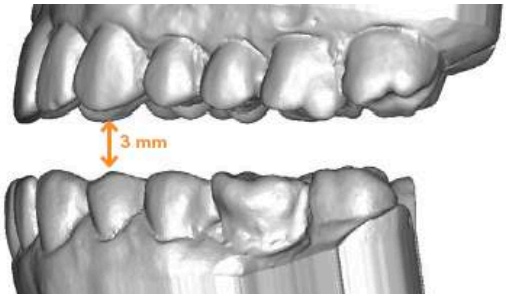
CA (Continuous Advancement) Appliance Options

ProSomnus [CA] Sleep and Snore Device Preferences Include:

- ❑ OK to adjust or close bite up to +/- 1 mm, call if >1 mm is needed
- ❑ Digital records OK; do not send back models
- ❑ Always reduce vertical up to 1 mm if possible
- ❑ Add lateral play for dual posts _____ mm
- ❑ Add reinforcement for dual posts _____ mm
- ❑ Add reinforcement for anterior: ❍ Lingual ❍ Facial ❍ Both

ProSomnus® Device Bite Requirement





More Practical Pearls

Chapter 19

Prosomnus MOG and MOG-MIP

Prosomnus Morning Occlusal Guide (MOG)

The AADSM recommends providing a patient a Morning Occlusal Guide, aka. Morning Bite Jig, AM Positioner, Bite Deprogrammer etc. Prosomnus has introduced a CAD/CAM Morning Occlusal Guide (MOG), manufactured from the same control-cured PMMA that the Prosomnus devices are made of, and from the same digital data used to make the appliance; no extra steps! These guides can also be manufactured from archived digital records, from a previously made appliance. The bite ramp is designed with precision through digital subtraction of the patient's maxillary dentition, gently guiding the dentition to the pre-treatment bite position ***Fig 1***.

Each morning, the patient gently bites into the MOG as long as necessary to establish the pre-treatment bite. Currently, Prosomnus provides two versions of these milled guides, the MOG ***Fig 2,*** and the MOG-MIP ***Fig 3***. Both have a ramp that guides the mandible back into the pre-treatment bite, and the MOG-MIP includes perforations at the posterior occlusal contacts allowing confirmation of establishing the original bite without removing the guide from the mouth. The MOG's ramp guides the mandible back towards it's pre-treatment position, but the MOG guide must be removed to confirm occlusion.

Fig 1: Bite Ramp

Fig 2: MOG

Fig 3: MOG-MIP

More Practical Pearls

Chapter 20

The OPTISLEEP: First Fully Digital Workflow

The OPTISLEEP: First Fully Digital Workflow

The **OPTISLEEP** appliance was designed by a master dental technician in Germany using CEREC and Sirona 3-D information. It is a two-piece EMA-style appliance milled out of PMMA acrylic, that is optimized to fit with digital accuracy, and with balanced occlusion, and covers all teeth to minimize tooth movement. Its slim design facilitates lip closure and thus Nasal breathing. The exchangeable advancing straps are available in 10 sizes.

When integrated with **Sirona's Galileos Comfort Plus** and **Orthophos SL3D-Ai** imaging units, the proprietary **SICAT Air** software can be used to order an **OPTISLEEP** appliance in a completely digital workflow; no need for conventional impressions and stone models.

Images provided by **SICAT Air** supports treatment compliance by creating an educational experience for OSA patients, may be useful as a communication tool between clinicians, and also allows for segmented analysis of the patients awake airway. Images of the TMJ that can be also used to assess TMJ health.

When the **MATRx plus™**, an "at-home" class II medical device that identifies patients suitable for oral appliance therapy is paired with **Dentsply Sirona 3D Imaging**, **SICAT Air** and **OPTISLEEP**, it completes a system that provides a complete digital workflow; allowing imaging, impression capture, outcome pre-evaluation and optimum bite registration, all with digital accuracy.

CAD/CAM Acrylic Appliances: The Future

The Future of CAD/CAM Acrylic Appliances

Since the Micro2 and OPTISLEEP were introduced, there have been a number of other CAD/CAM sleep appliances enter the market. For reasons that must be self evident by now, we can expect more! It simply makes sense; smaller, stronger, more accurate and easily modified.

Other CAD/CAM milled acrylic appliances currently available:

- **DynaFlex Custom Milled Dorsal Style Appliance: 3 Year Warranty**
- **DynaFlex Custom Milled Herbst Appliance: 3 Year Warranty**
- **True Function Custom Milled Adjustable Herbst Appliance (TrueHerbst)**
- **This list is growing with regularity!**

DynaFlex Milled Dorsal

More Practical Pearls

Chapter 21

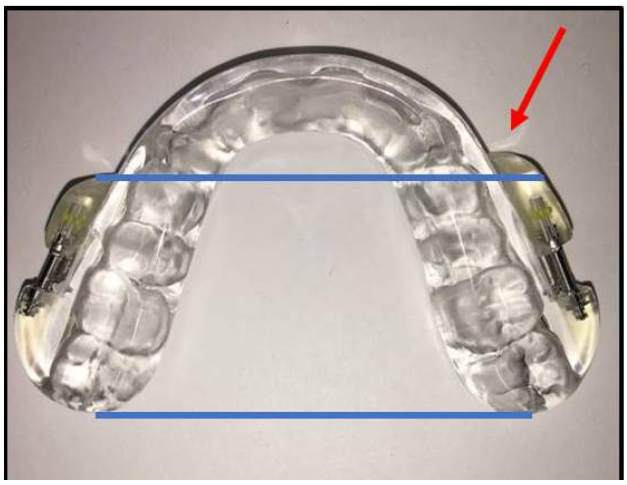
CAD/CAM Acrylic Appliances: The Future

CAD/CAM Appliances - Apples and Oranges

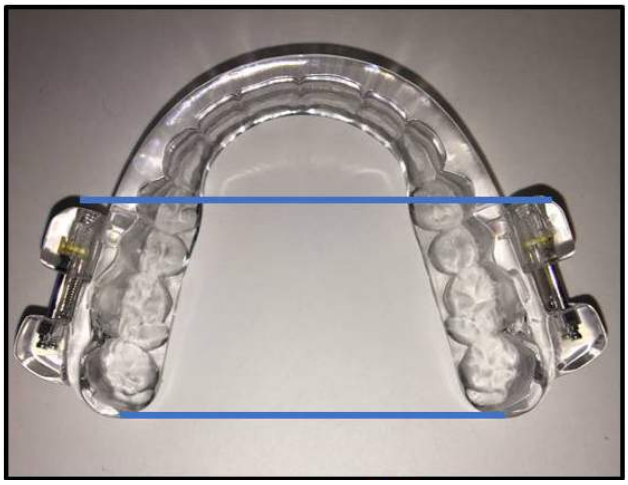
With more CAD/CAM milled offerings coming our way, we need to be able to differentiate them. Not all CAD/CAM Milled Appliances are manufactured in a like manner. Unlike the **Prosomnus appliances**, which are engineered completely in the software and Milled as one piece, some of the other offerings Mill the platform only, then hand make the rest of the appliance. This of course, makes it impossible for the software to engineer the advancement mechanism, potentially resulting in uneven advancement.

Best to ask before ordering a CAD/CAM appliance.

• Product "D"



ProSomnus [CA]



More Practical Pearls

Appendix

FAQ

Q: Can Nylon appliances be adjusted to fit around a new crown?

A: Yes, it is best to provide the lab with a model of the original dentition when making a new crown to fit under a nylon appliance. This would ensure that any required adjustments would be minimal. See section: "***Clinical Experience: Enhancing Retention Case Study"***

Q: Can vertical be adjusted after fabrication of a Nylon appliance?

A: Yes, thanks to our colleague Todd Morgan. Todd has developed individual inserts of varying thickness (1, 2 and 3 mm) that can be added to the Narval CC or D-SAD to increase vertical; the "V-Tab". These tabs can be ordered from "True Function Dental Laboratory" in La Mesa California. For more information on the V-Tabs you can speak to Frank at True Function Dental Laboratory.

Q: How do I deal with retention issues for Nylon appliances?

A: Retention issues can present with any of the oral appliance offerings. What is important is not whether there is a possibility of retention being an issue with a nylon appliance, but rather, how do I deal with retention issues when they arise. The chapter on increasing retention clearly explains how retention can be enhanced on a Nylon appliance but let's take a moment to review some of the potential causes of inadequate retention and how to avoid them.

First off, the quality of the initial impression is of paramount importance. All details of the entire dentition along with a collar of gingiva around each tooth must be accurately captured. These 3-D printed appliances are a "precisely fitting appliance", and if the initial impression is less than optimum, this will impact on both over-all fit and retention.

FAQ

Second, for the Narval CC I always check the box indicating that a full wrap Anterior Band is pre-approved if required. This allows the technician working on the case digitally to use a full wrap if the level of retention from the teeth is insufficient with the standard band (see chapter on various Band Designs). Using a Full Wrap Band stiffens the appliance considerably, allowing the undercuts from one side to play off undercuts on the other side as opposed to the Standard Band, which can only rely on undercuts to play off each other from within a quadrant due to the suppleness of the Standard Band.

It is also very important to understand that just because a patient can pull out of the appliance by opening the jaw chair-side does not translate out to the appliance coming off during sleep. The dynamics of the appliance in function while asleep are different and I find that one does not necessarily lead to the other.

With extreme advancement, patients sometimes pull out of the appliance easier than with less advancement, this is also the case with other appliance designs. This is where the thermoplier trick comes in very handy, tweaking the retention a bit to counteract the additional muscular opposition with extreme advancement. Also, keep in mind that as this individual becomes accustomed to wearing the appliance in the more advanced position, the muscular opposition reduces with time, possibly eliminating the retention problem. So, if they are only pulling out of the appliance occasionally (rather than nightly), simply monitoring this issue is often all that is required. As they acclimatize to the level of advancement, they stop pulling out of the appliance.

Finally, for some patients that are pulling out of their appliance nightly, placing a strap with less advancement for a period of time may help. After spending longer in this less advanced position and acclimatizing to it they may be able to tolerate further advancement with less muscular opposition reducing or eliminating the retention issue.

More Practical Pearls

Appendix

FAQ

Q: How can I justify the higher than average Lab Fee?

A: Actually, this is an easy question to answer. These Nylon appliances are exceptional from a feature aspect, but in my mind, what really makes them a worthwhile investment is the durability factor. Type-12 nylon is very durable and able to provide patients with many repair-free years of use. Acrylic appliances break and require repair much more often than desirable (actually, even once is more often than desirable). This simply does not happen with Nylon appliances. This price point might not be appropriate for every patient, but given the option, you may be very surprised at how often a patient is willing to pay for this level of quality. Just like CPAP has different options and levels of device, the same holds true for appliances. The real question is why would you not want to at least offer the top of the line appliance to each and every patient you see? Let them decide.

Q: How do I effectively present a 3D printed Nylon appliance to a patient?

A: Here is what I do in my office for those patients that are candidates to wear a Nylon appliance. When I get to the part of the consult where I am showing the patient appliances, I hand them a sample of an "Old World" Acrylic appliance (pick your favorite one) and a "New World" Nylon appliance (either a Narval CC or D-SAD), so they have an Acrylic appliance in one hand and a Nylon appliance in the other, then I tell them…

"The advent of the 3D printer now enables us to make appliances out of Nylon. We have never been able to make appliances out of Nylon before so this is a whole new experience for us. Nylon appliances can be made much smaller and lighter but provide more strength and durability than the "Old World" Acrylic appliances. But, both will take care of your snoring and apnea with similar effectiveness."

Then I stop Talking…

More Practical Pearls

FAQ

I sit there and watch the patient handling both appliances.

Almost exclusively, everyone looks at me and says,

"I want the Nylon appliance please".

More Practical Pearls

Appendix

Executive Summary

Research findings continue to be supportive of Oral Appliance therapy and the optics of "Mean Disease Alleviation" is changing how people view Oral Appliances. More and more studies are demonstrating their clinical utility, even for severe OSA. Oral Appliances are finding their way into areas that they have been formerly unwelcome in, such as managing OSA in commercial drivers and managing Severe OSA. It is safe to say that Oral Appliances have come of age. We have gone up quite a learning curve over the last several years with these "New World" Nylon appliances, and the journey continues. My sincere desire is to provide a communication portal to help share these new findings, techniques and "Practical Pearls" as they become available. I invite you to consider joining the "SleepDisordersDentistry" Linkedin Group, and sharing your thoughts and experiences in this area. Discussions from that venue will find their way into future eBooks. I am happy to provide this major update of the "Practical Pearls" eBook first published in February 2015. Future updates will become available as important and pertinent information comes to light. These eBooks will always be a ***"Work in Progress".*** So remember, ***"If you quote me, date me".***

Dr. Viviano *obtained his Dentistry credentials from the University of Toronto in 1983. His clinic is limited to managing sleep-disordered breathing and sleep-related bruxism. He is a Credentialed Diplomate of the American Board of Dental Sleep Medicine and has lectured internationally, conducted original research, and authored original articles on the management of sleep-disordered breathing. His clinic is the first Canadian facility accredited by the American Academy of Dental Sleep Medicine. Dr. Viviano also hosts the SleepDisordersDentistry LinkedIn Discussion Group and conducts dental sleep medicine CE programs for various levels of experience, including a 4-day Mini Residency.*

Most Sincerely,
John Viviano DDS D ABDSM

More Practical Pearls

Appendix

Aknowledgements

Much of the content in this eBook has been reprinted from it's original postings online.

I would also like to acknowledge ***Randy Clare for his own "Practical Pearls".*** I always find my conversations with Randy to be educational, enlightening and inspirational.

Also, a special thank you to those that contributed their clinical expertise, this eBook is about sharing clinical experiences so that we may all benefit.

In order of appearance in eBook:

- ***Ludovic Baratier Dental Technician, Inventor Narval CC***
- ***Diane Robichaud Dental Technician, co-developer D-SAD***
- ***Lionel Dwyer Dental Technician Orthodent Laboratories***
- ***Todd Morgan DDS Diplomate ABDSM***
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- ***John Carollo DMD***
- ***Jacques Houde BSC DMD***

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Sleep Disorders Dentistry Resources

Online Sleep Rounds Blog for Evidence Based Clinicians – **Free to Join SleepDisordersDentistry LinkedIn Group**

Airway Aware eBook – Become Airway Aware. Sleep Optimally and Live Optimally. Download your **Free copy at AirwayAware.com**

All Levels of Sleep Disorders Dentistry CE
Become a Competent Sleep Disorders Dentist
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- **Of Special Interest to Human Resources Officers**
- **Call for a private consultation**

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Appendix

Housekeeping

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