



London School
OF FACIAL ORTHOTROPICS

HYBRID HANDBOOK

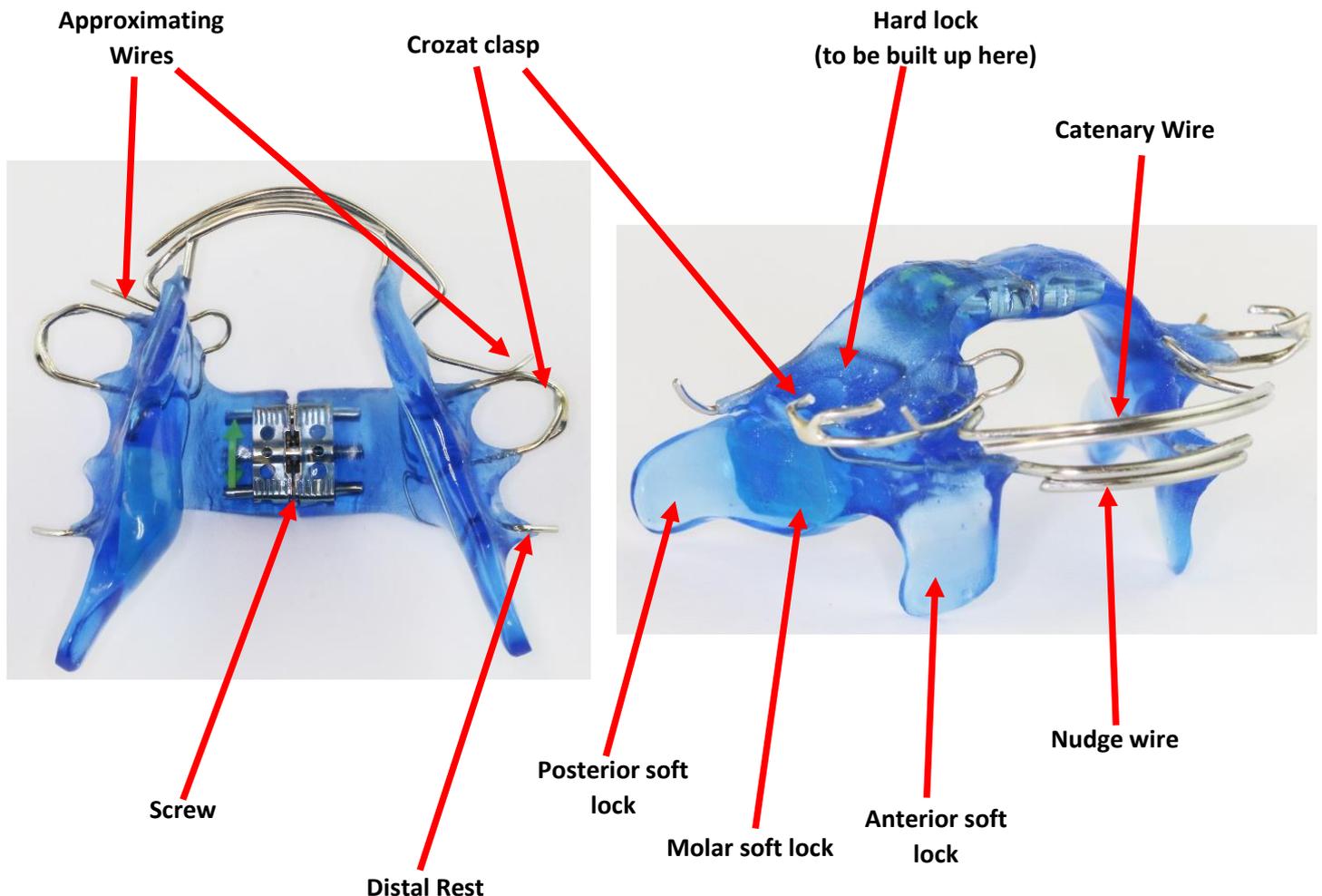


Hybrid Course

HYBRID APPLIANCE- Training + Expansion

The hybrid appliance combines the Stage 3 training appliance with maxillary expansion. In this way, the patient is taught to change at the same time that structural change is underway.

The teeth are moved out of their balanced zone. In turn, the balanced zone changes due to change in posture and function, to hold the teeth in their new position.



Important components of the Hybrid appliance:

Clasps: At each visit the fit must be checked to ensure the clasps are providing adequate retention. The clasps should be placed either on the E's or premolars with rests on the 6's, or on the 6's with rests on the 7's.

Distal Rest: Check the distal rest is active to prevent the appliance rocking distally.

L-number: Once the clasps have been checked, the L-number can be determined. This is the mandibular jaw gape at which the soft locks contact the soft tissue and will indicate how much a

patient can hang their mouth open while wearing the appliance. The lower the L- number, the more effective the feedback mechanism of the appliance. If the L- number is greater than 1, we can consider adding to the soft locks to further engage the undercuts.

Soft Locks: Soft locks are built up at the chairside in acrylic and aim to engage the undercuts of the mandible lingually in the anterior, molar and posterior regions. It may be necessary to add to the anterior, posterior and molar lock (see sheet on soft locks) at each visit to engage the undercuts which will remind patients to keep their mouths shut.

Screws: The screw is activated (opened) $1/8^{\text{th}}$ (45°) of a turn a week. The length of screw = 12mm and therefore expands the maxilla 0.1mm each week. At the end of this phase if the screw has been fully opened, the maximum widening of the maxilla is 12mm. However, the screw is never fully opened.

Calculating the number of turns between appointments:

The Hybrid appliance is turned at $1/8^{\text{th}}$ rotation each week.

When counting the turns, the key must close the screw (rotating it in the opposite direction to the arrow shown on the appliance) i.e. turn backwards. It is important to count each $1/8^{\text{th}}$ of a turn and not to lose count or get distracted. Once the screw has been fully closed and can no longer be turned backwards, the number of turns should be noted down. This can then be compared to the number of turns counted at the previous visit.

$$X1 - X2 = X3$$

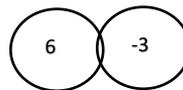
Where X1- number of turns counted today

X2- number of turns recorded at previous visit

X3- number of turns carried out by the patient at home in between visits

Calculating if the number of turns are correct

The number of turns should = number of weeks between visits. If there is a discrepancy in the number of turns, make a note of this. For example, if there were 6 weeks between the appointments and only 3 turns had been made, this would be noted as



Some difficulty may be experienced when counting turns on a stress breaking screw. This is because the screw is designed to 'slip', dissipating the stress.

Screws should not be turned until:

- 1) Wear ≥ 8 hours/day
- 2) L-1

This ensures that once the maxilla is widened, teeth will be held in a position of equilibrium. The mandible is a single bone, which limits the rate of expansion. The mandible and maxilla are expanded at the same rate and thus the occlusal relationship of the buccal segments is not disturbed.

The Latest Hybrid Design



The latest modification to the Hybrid design (and all training appliances) is to extend the posterior lock mesially, creating the “molar lock”. This came about due to the success of the molar lock where it is relatively effective at engaging the undercut in this area. It is therefore important to ensure a good lower impression is taken to allow correct extension into this area. It may be necessary to add to these locks at repeated visits depending on the L-number.

During the appointment:

- 1) Take and record data from the Theramon device. Analyse the pattern of wear and if poor, find out why by considering the detail of hourly wear and motivate if necessary.
- 2) Count the number of turns of the screw. Patients wearing this appliance are instructed to turn the screw once a week. Once the number of turns have been counted, check this against the number of weeks since the last visit and the number of turns registered at that visit. Record this in the notes and then rewind the screw to its current position.
- 3) Check the fit of the appliance. Clasps may need to be adjusted if fit is compromised.
- 4) Check the L- number. L-1 suggests the appliance is effective at reminding the patient to keep their mouth shut and are only able to drop 1mm before the soft locks engage. The “L-number” refers to the number of mm the mandible can drop before the locks engage. It is usually best to ask the patient to drop in a controlled manner until they report contact with the soft tissue. They should then be asked to close back into “home position”. A mental note is made of the distance between the position of engagement/contact and home. In some cases, patients may present with L-(infinity) and this would suggest that the locks are ineffective at reminding the patient to keep their mouths closed as they do not engage in any undercut. Thus, the patient can open without any reminder/feedback mechanism.

- 5) Examine intra-orally any areas which need addressing. If the lower molars need to be moved buccally, the hard locks can be added to and over time the buccal teeth will move away from the hard locks gaining effective expansion.
- 6) Any sore areas should be relieved to prevent discomfort as this will inevitably result in poor wear and compliance.
- 7) If $L > 1$, the soft locks will need adding to engage in the undercut. Recently, the molar lock has proved to be the most effective lock at providing a feedback mechanism and undercuts can usually be found intra-orally inferiorly and distal to the lower 6's.
- 8) Once the clasps have been adjusted and locks have been added to, check again that the patient finds the appliance comfortable. If they are in any discomfort at rest (with mouth closed) adjust the appliance as necessary.
- 9) Measurements of the intermolar width can be taken at visits to determine the level of expansion due to opening of the screw.

Instructions for patient:

Before the patient leaves, it is important to ensure they can wear the appliance comfortably. It may be necessary to get the patient to relax in the waiting room for 10 minutes while wearing the appliance.

If the soft locks have been added to, instruct the patient they **must not** to go straight into night time wear of the appliance.

- 1) For full-time wearers (occasionally advised): they must first ensure they can wear the appliance during the day without any problems before they can wear it at night.
- 2) Night wearers: If they are to only wear the appliance at night, they must wear it for the first two days during the day. If no problems occur, they can go into night time wear on the third night.

Recall Intervals:

Every month if screw is being activated each week

Every 2 months if the screw is not being activated each week.

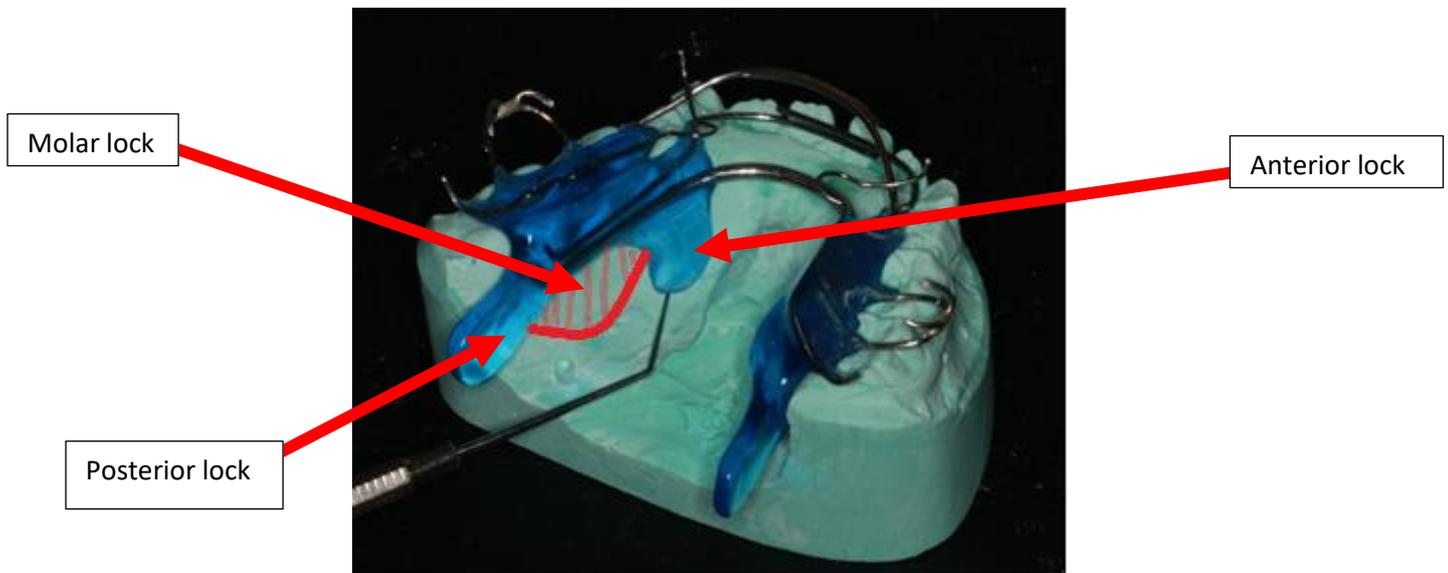
Important points to note:

- The Hybrid may be difficult for the patient to accommodate and wear if molar width less than 35mm as it occupies tongue space. As such, some pre-expansion may be necessary.
- We usually aim for a minimum of 5mm expansion, with a molar width of at least 38mm. This is generally where stability can be gained in the average patient.
- Once expansion is gained, the appliance can be converted to an open top where the screw is removed thus creating more tongue space.

- During the conversion process, the approximating wire can be moved from the canine to the first premolar.
- The appliance can be worn during the night only once expansion is no longer being gained. The 1-hour conscious wear (awake time before bed) is no longer necessary.

Soft locks

The purpose of the locks are to engage in soft tissue undercuts of the lingual sulcus to create a feedback loop to raise the habitual mandibular postural position and increase the resting muscle tone of the mandibular closing muscles. Due to the position of these locks, they stick down, and the patient very quickly learns via proprioceptive feedback to move the jaws forwards and down around the locks when opening. This is a sign that the patient is wearing the appliance well.



To test the effectiveness of the soft locks, the patient must slowly open in hinge axis until they make initial contact with the soft tissue. This allows us to view the freedom of motion before the locks touch.

Testing: place fingers firmly on chin and mandible to guide the motion. Instruct the patient to gently drop downwards while guiding them until the locks lightly touch the soft tissue. It is important to explain to the patient beforehand what you are doing and to confirm that they feel the locks engaging by asking them to point intra-orally where they touch on opening.

Once the locks contact soft tissue, the patient must stop dropping. They must then close in a single observable motion. A visual approximation is made of this motion which is known as the L-number. The lower the L number, the more effective the feedback mechanism of the locks.

L-1 is easily achieved in class III patients as they have excellent undercuts to engage and in patients who keep their mouths shut at rest, who display an anterior rotational pattern.

Adjusting the soft locks: The feedback loop from the soft locks is a crucial aspect of the therapy. If a patient can drop more than 1mm, the locks must be adjusted. No expansion of the appliance should be undertaken until this is corrected.

The surface of the locks is roughened with an acrylic bur. A hard setting acrylic, preferably monomer free, (much like denture reline material) is then added to the locks before being placed back in the patients' mouth to mould them. In essence, an impression is being created by the acrylic while still in a pliable state. It is important to get the patient to close in a particular manner during this process by

bringing the jaw maximally forward, effectively following the outside limits of Posselt's envelope of motion.

Once the acrylic has hardened, it can then be trimmed and smoothed to create a shape which will then engage the undercut as well as removing any flash of acrylic. Re-insert appliance with modified soft locks and check for comfort. If needed, adjust as necessary (i.e. if patient is in too much pain/discomfort at rest).

Molar soft locks:

The most recent soft locks which have proved successful in engaging soft tissue undercuts adjacent to the lower distal molar region. Having gradually added on to anterior locks, certain patients were returning with L-infinity ($L-\infty$) which meant that these soft locks were struggling to engage in the undercut and therefore providing very little feedback to the patient. On further intra-oral examination, the undercut just anterior to the retromylohyoid area, adjacent to the lower distal molar, proved to be a good undercut to engage into. It has proved to be extremely effective in nearly all patients and also causes far less trauma, perhaps due to the increased mobility of the soft tissue in this region.

It is important not to add to the soft locks immediately after the hard lock. The hard lock lightly touches the teeth, as such, the reciprocal force from this narrows the appliance slightly. This potentially allows a greater addition of material to the soft locks which would then engage too much once hard locks have been effective and the teeth have moved, usually after a few days. It is however possible to add to both hard and soft locks at the same time.

Adjusting soft locks- when a patient returns in pain/discomfort

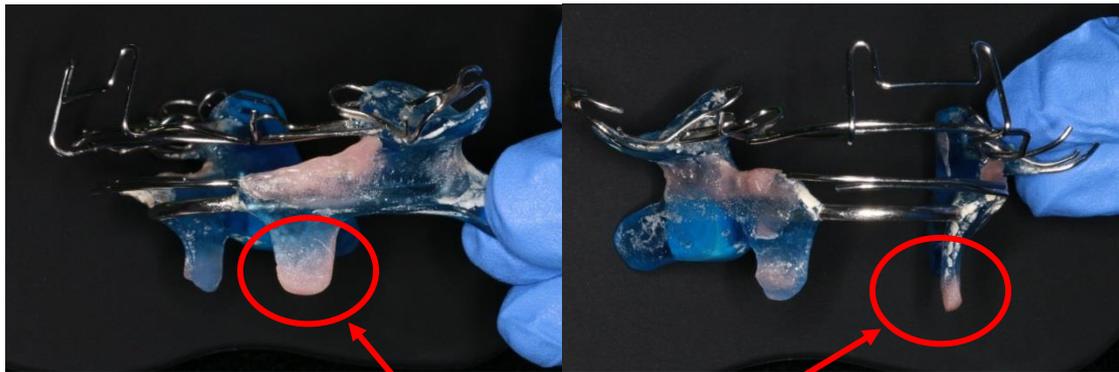
The training appliance should be assertive but not uncomfortable. This is a fine balance and some problems are to be expected. A painful or uncomfortable appliance must be adjusted so that it can be worn without problems.

Before making any adjustments to the appliance, the specific site must be identified. If the patient is complaining of discomfort on the left side, get them to use their right index finger (fully extended with the other fingers curled into a fist ) to point to the area of pain. This ensures the area is in the line of vision and can be clearly seen by the clinician.

It is worth telling patients to wear the appliance causing discomfort for a considerable length of time (12 hours if possible) before attending the appointment. This is so any sore areas can be clearly visualised and the offending area on the appliance easily detected.

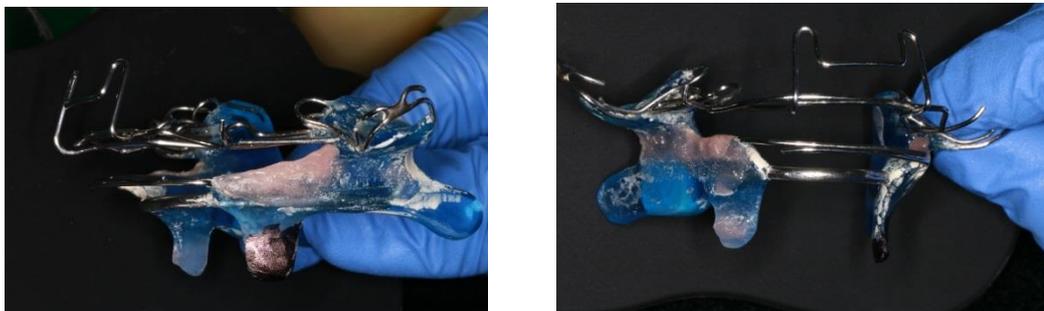


This patient returning complaining the anterior locks on the left side was digging in to the area under his tongue.

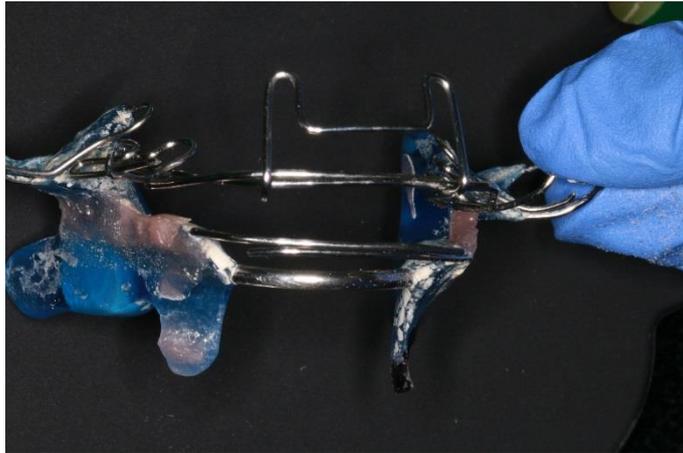


The offending lock

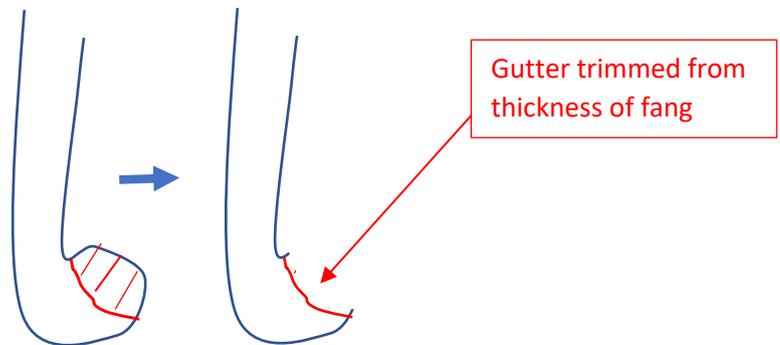
Here we can see the fit surface of the lock (left image) as well as the cross-sectional view (right image).



Here the anterior offending lock has been blacked out to allow for better visual image so that we can see how much acrylic will be trimmed away.



Note how a 'gutter' has been trimmed away from the cross-sectional thickness. The lowest aspect of the tip has not been trimmed and can still engage in the undercut.



From the illustration above, we can see that the length of the lock has not been altered.



The tip is then smoothed with the motor of the straight handpiece running at low torque.

Expansion using the Hard Locks

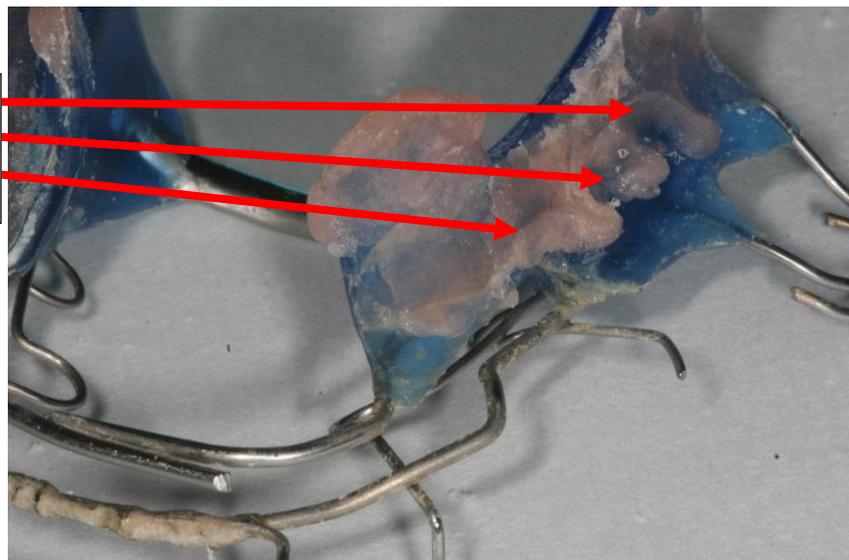
These involve adding acrylic on the hard lock of the stage 3 appliances which contacts the lingual aspect of the lower posterior teeth. The aim of adjusting these hard locks are to increase the thickness of the acrylic in order to achieve an element of expansion in the buccal direction.

The photographs below show the molar teeth falling into a potential scissor bite as the upper arch is expanded at a faster rate than the lower arch. Adding hard locks to exert force on the lingual aspects of the lower molar teeth will help to push them buccally and therefore correct this potential problem.



The acrylic on the fit surface of the appliance is roughened with an acrylic bur. Acrylic material (similar to denture re-line material) is then flowed onto this area before being inserted in the patients mouth for an impression of the mandibular buccal segments to be taken in the acrylic.

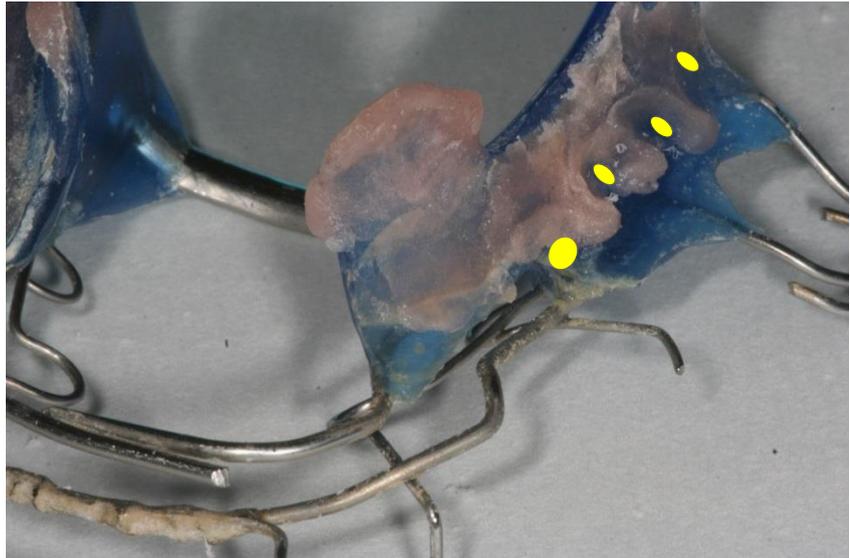
These depressions mark where the teeth come into contact with the acrylic.



NB. This photograph was taken with the appliance upside down.

The yellow spots mark the depressions and the areas which should NOT be trimmed.

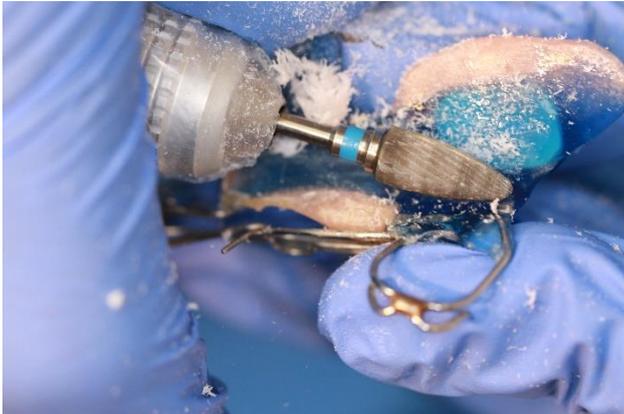
The idea is that once the excess acrylic is trimmed from around these areas, these depressions or 'Valleys' become the most prominent points or 'mountains'. This will exert a small but constant force on the lingual aspect of the posterior teeth causing the lower arch to expand buccally.



In some cases, it may only be necessary to add to the hard locks on one side to gain asymmetrical expansion.

Step by step guide to adding Hard Locks:

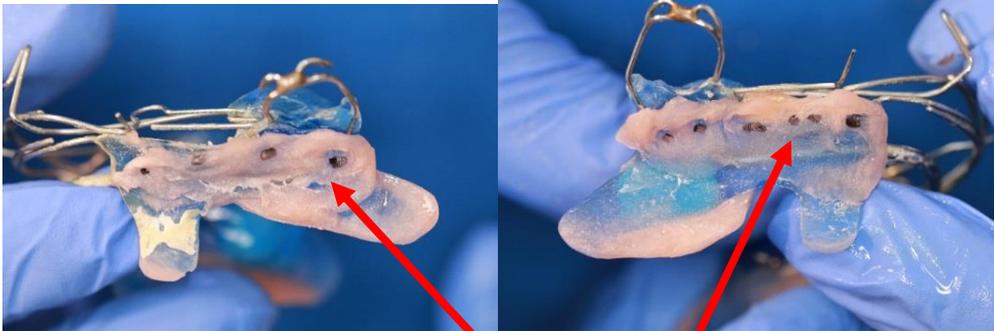
- 1) **Roughen the acrylic where the hard lock is to be added**



- 2) **Add the acrylic to this area. Try and 'bead' the acrylic on in one go. Dip it in hot water to create a 'skin' on the surface of the acrylic.**

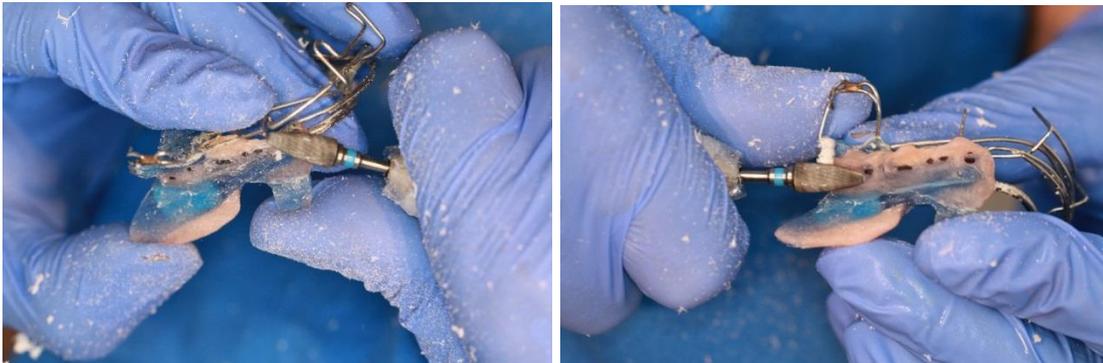


- 3) Insert the appliance in the mouth. Ask the patient to bite into the appliance normally. The teeth will mark the acrylic where they make contact. The spots marked show the depressions created by the teeth.



These depressions mark where the teeth come into contact with the acrylic.

- 4) Trim the areas AROUND the indentations, and ensure the indentations are NOT trimmed. The benefits of marking these areas with spots are to maintain the spots while trimming the excess acrylic.



The final result shows the depressions have now become small protrusions as the acrylic was trimmed around them leaving them as raised areas. These will exert a constant force on the lingual aspects of the lower molars to expand the lower arch.

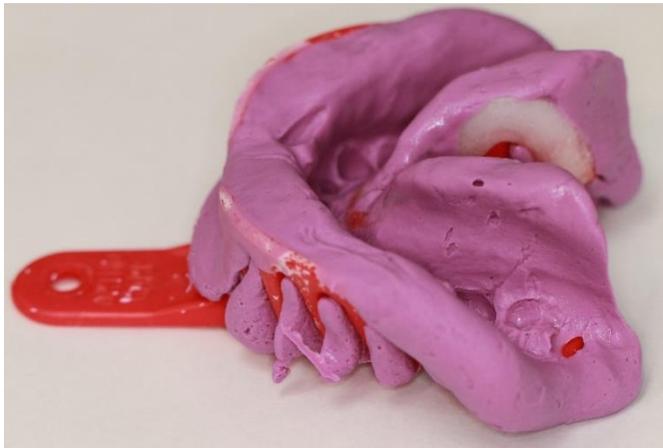
Lower Impression Taking- Hybrid Appliances

The stage 3 appliance needs to extend lingually and distally to engage the mandibular undercuts. For this reason, the impressions taken need to accurately replicate the anatomy in this area. If the impression does not extend into this area, it leaves the technician with no indication of the anatomical structures and much guesswork is needed to construct the soft tissue locks.

The images below show two very different impressions which have been taken of the same patient.



This first image depicts a poor impression. Note how there is no lingual extension of alginate making it impossible for the technician to create soft locks.



This is an image of an ideal impression with correct lingual extension. A technician would have no difficulty constructing soft locks.



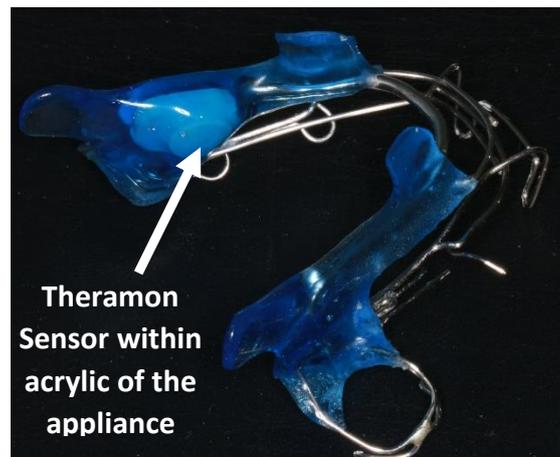
This impression is sub-standard. Note the lack of extension lingually.

This impression has captured the anatomy lingually and extends deep into the tissues where the soft locks aim to engage.

When taking the lower impression, it is important to give clear instructions to the patient and to not fully seat the tray until the patient has placed their tongue on top. Once the patient has placed their tongue on the top of the tray, ask them to relax before fully seating the tray. Extending their head back also helps. Ensure a constant pressure is maintained on the tray to accurately capture the structure of all the hard and soft tissues.

Theramon device:

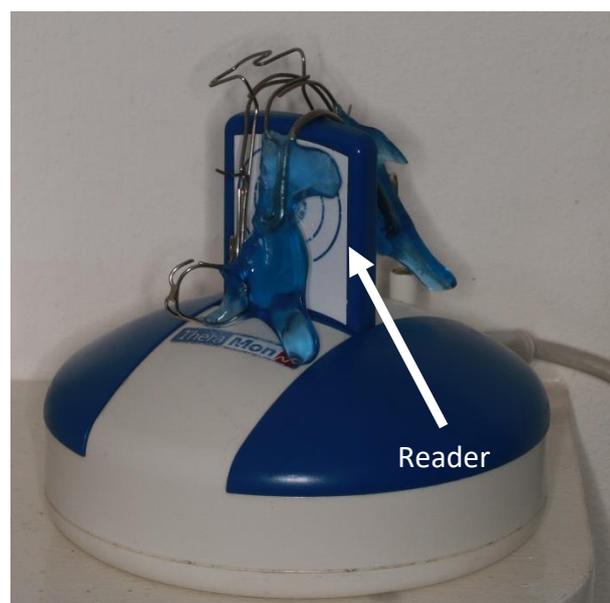
The success of Orthotropics treatment is fully dependent on the cooperation of a patient whereby the better the wear, the better the outcome. To assess wear, a timing device is placed in appliances. The system we currently use is the Theramon device. It is 10mm in diameter and 4mm in depth and is easily placed within the acrylic of appliances during construction. The Theramon sensor is activated by temperature and can detect fluctuations in temperature change to a few degrees. Readings are registered every 20 minutes.



In this way, we can reward good wearers and motivate those who are not as compliant.

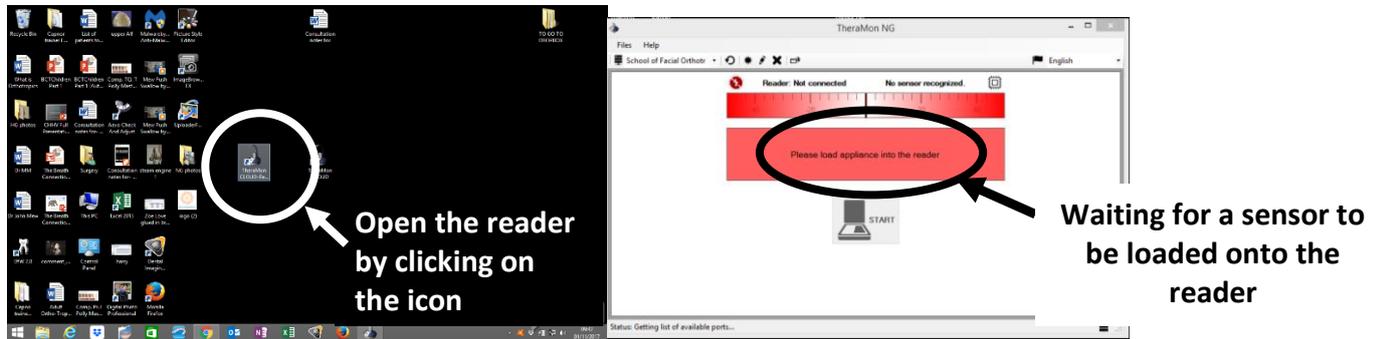
Reading the device and obtaining data:

In order to obtain a reading, the sensor is placed close to the reader as shown in the picture below. For infection control purposes, the devices are placed in transparent plastic bags and then placed close to the reader to minimise cross contamination.

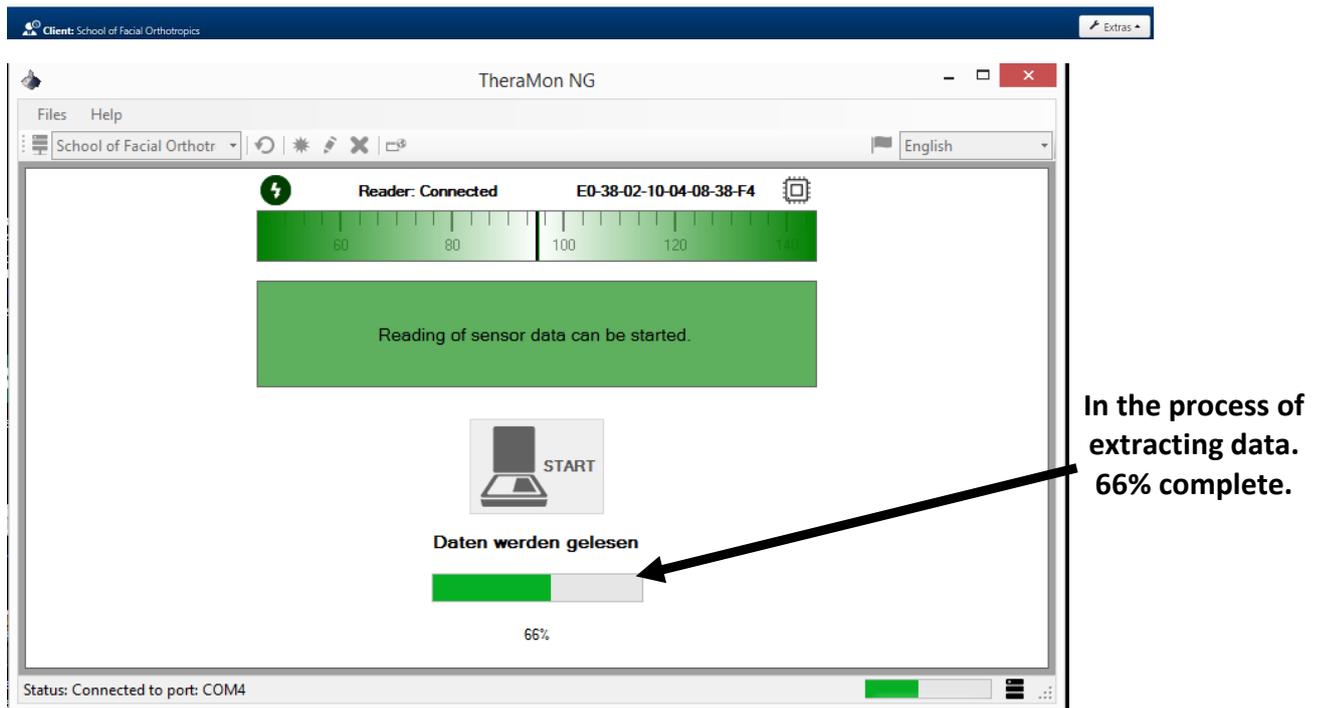
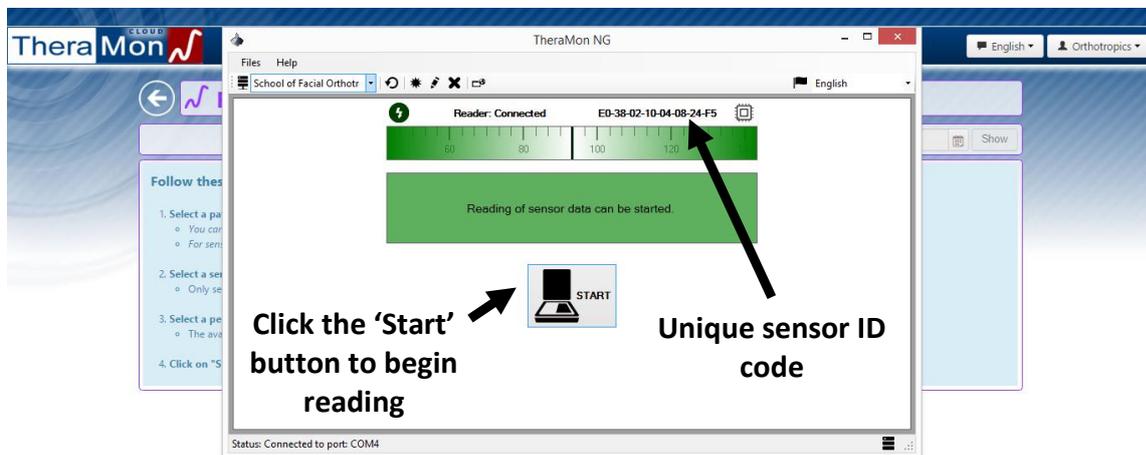


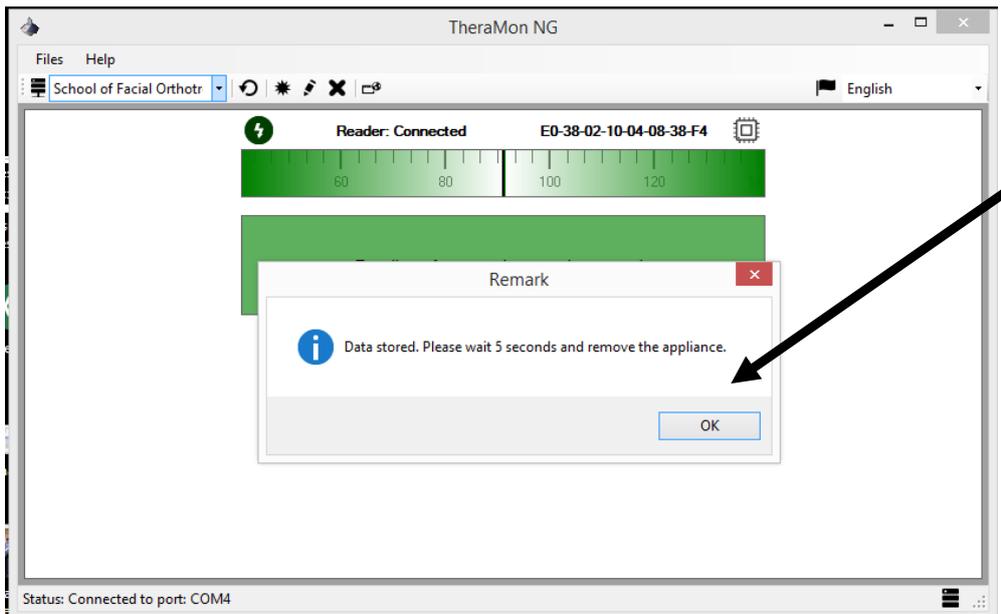
It is important to remember the identification number of the sensor as a patient may have multiple appliances with multiple sensors each with their own unique identification number.

Taking a reading:



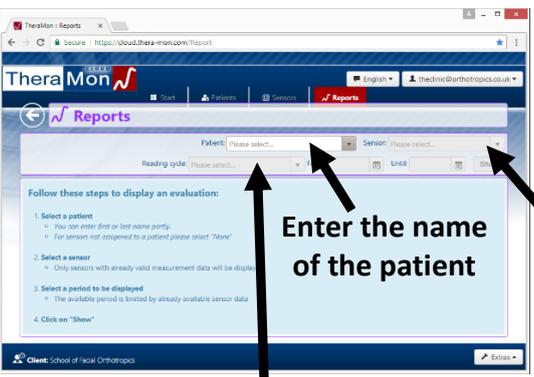
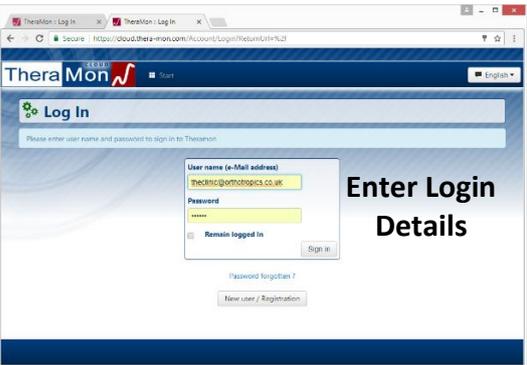
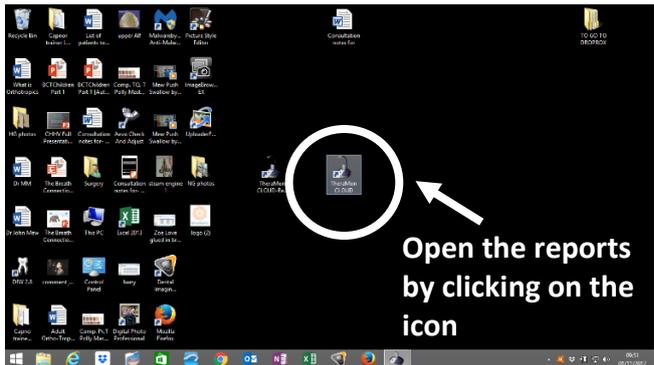
When the sensor is placed in close proximity to the reader, the 'Start' button should illuminate indicating the reading may be obtained.





This window is displayed once the data has been extracted. It is important to wait 5 seconds before removing the device from the reader to avoid losing any data.

Accessing the Software:



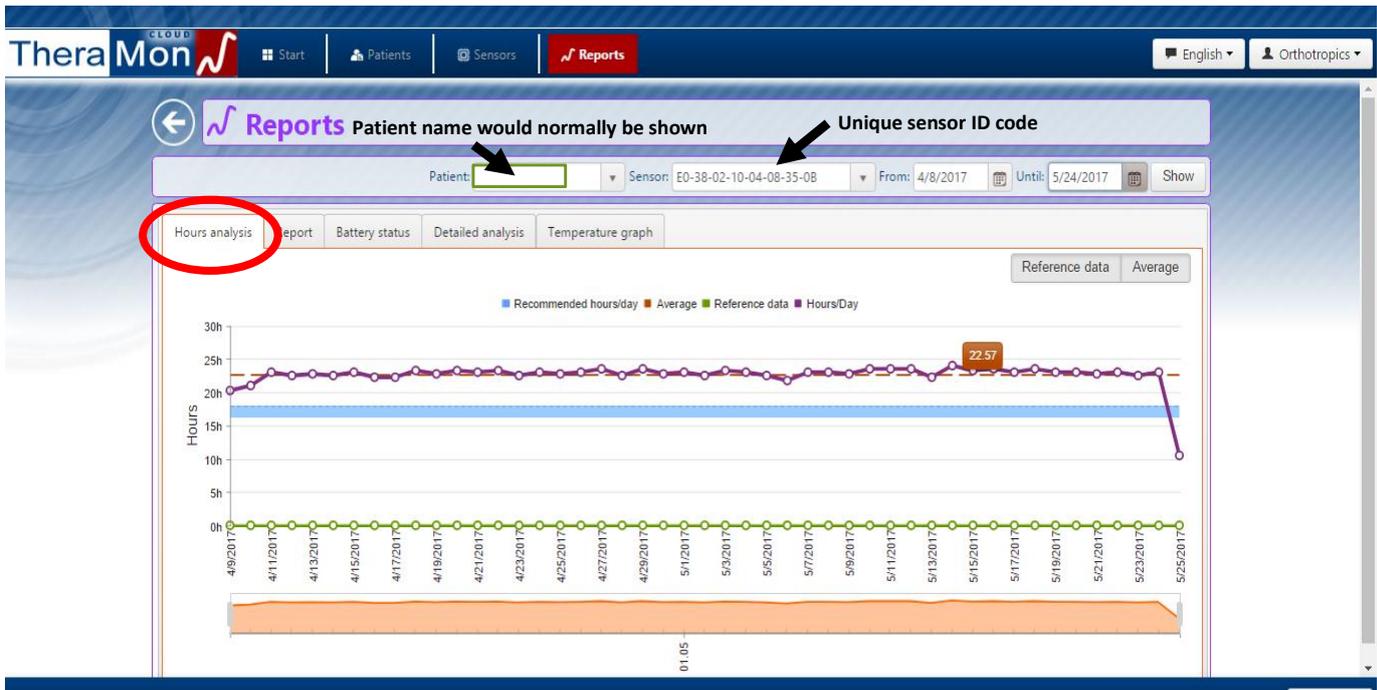
The 'Reading Cycle' should reflect the date between the current appointment (today) and the date of the previous appointment when the last reading was taken.

Interpreting Graphs:

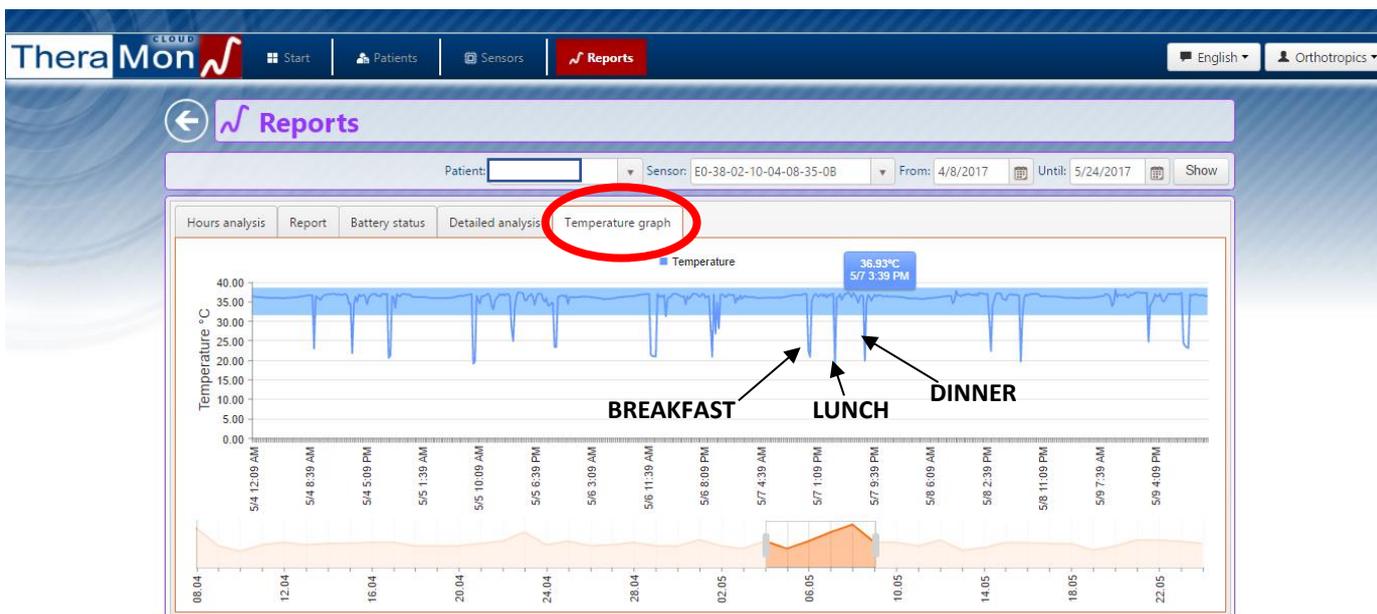
Below are very different graphs comparing an excellent appliance wearer with a non-compliant patient with poor wear.

Compliant patient

The graph below (found on the 'Hours analysis' tab) shows an extremely compliant patient who is wearing their appliance for an average of 22.57 hours a day (orange box) during the period of 4/8/2017 – 5/24/2017.

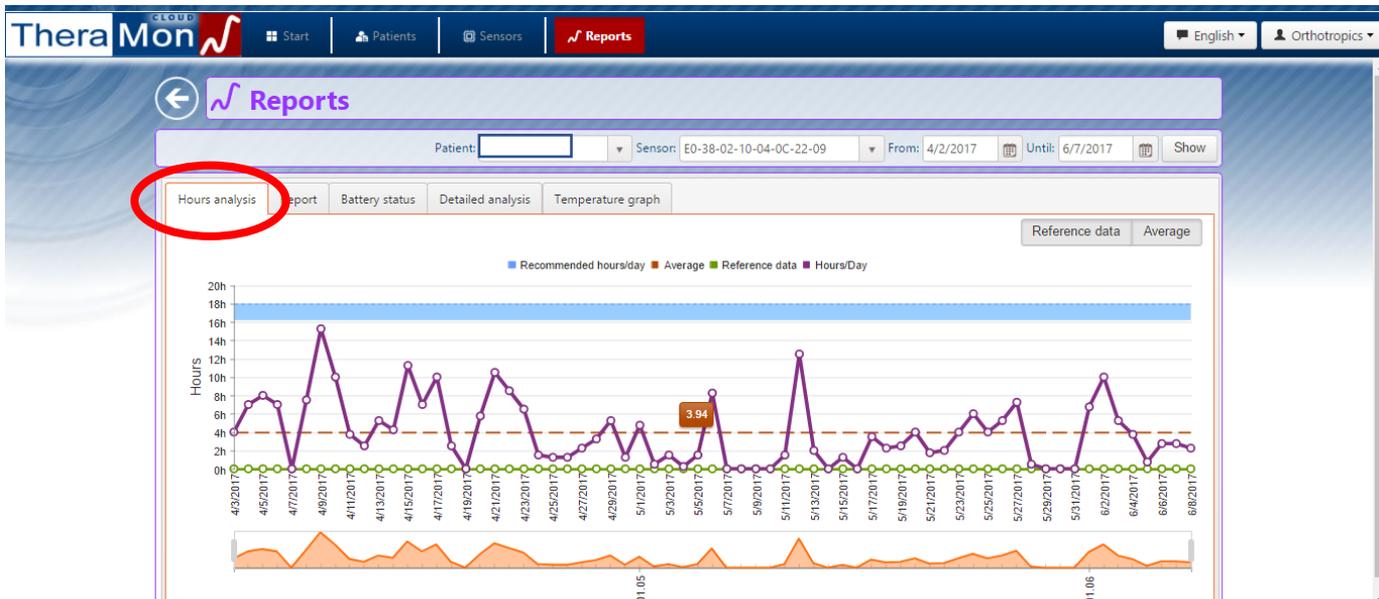


If we now look at the temperature graph below, during this same period, we can analyse the times where the appliance is not being worn. If we focus on the 5/7/2017 we can see the temperature drops to around 20°C three times on this day and those timings coincide with breakfast, lunch and dinner when the patient would have removed the appliance to eat.

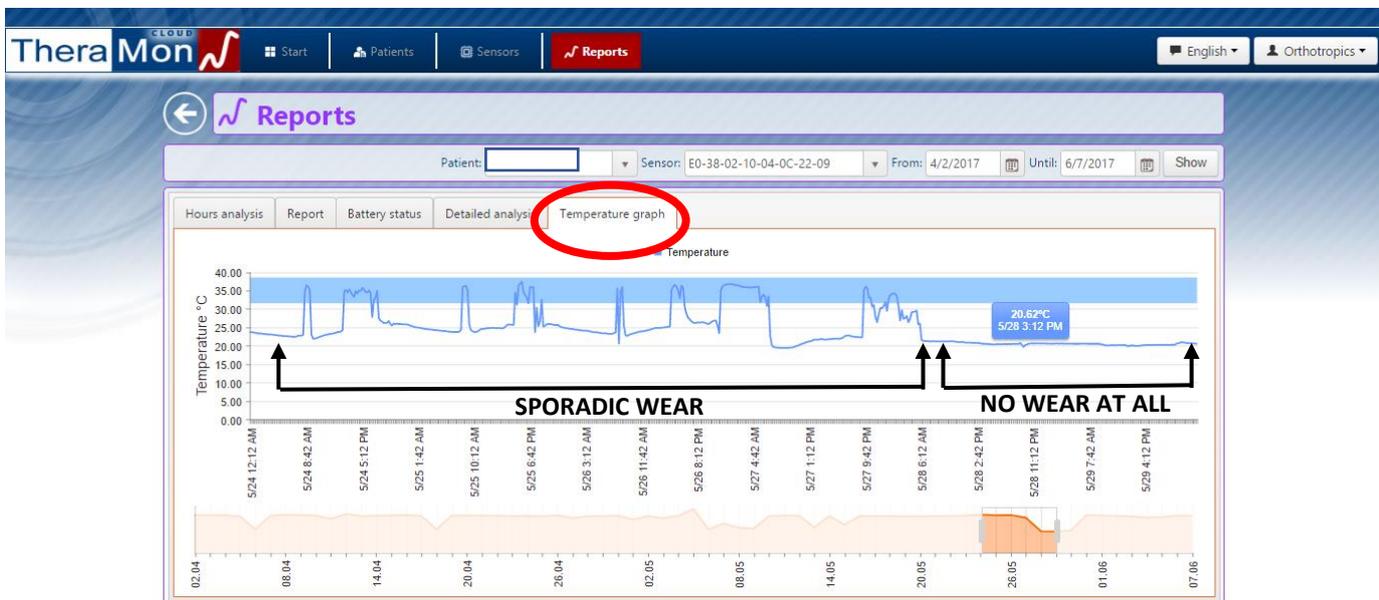


Non-Compliant Patient

By contrast, the graph below shows a poor appliance wearer. This patient is only wearing their appliance for 3.94 hours/day during the period of 4/2/2017 – 6/7/2017.



The temperature graph for this same patient shows there is no pattern to the wear and even shows a period of no wear at all.



The temperature graph can be used to ascertain that the 1-hour conscious wear is constantly being achieved. This may be done by asking patients to brush their teeth right before bed but just after the 1 hour of conscious wear. The temperature graph should display the 1 hour of wear followed by a drop in temperature (when the patient brushes their teeth) followed by a rise in temperature again as they wear the appliance to bed.

