Orthotropics is based on the belief that there is a significant environmental influence on the aetiology of malocclusion and that malocclusion is one of several symptoms associated with a change in facial growth direction, as described by the concept of Craniofacial Dystrophy. Other associated symptoms may include sleep apnoea, ENT problems, and jaw joint issues as well as a forward head posture which can in turn influence body posture. Effectively a structure whose architecture is compromised does not function as effectively.

Orthotropic therapy can have a significant effect on general health as it involves gaining changes in structure of facial and dental form as well as changes in posture and function.

Orthotropics is a lot more like teaching than treating. The analogy is that we are top sports coaches providing several sports training programs and our students frequently gain gold medals. The result is far more dependent on the individual than the appliances or the specific program. Getting a gold medal is not easy, nor is changing your function and posture. We can only create the environment for people to change, it is a case of “you can lead a horse to water, but you cannot make them drink”.

Facial change due to posture:

This patient rested with an open mouth posture majority of the time. Over time, this has resulted in an elongated face as the mandible is positioned downwards and backwards. The maxilla, unsupported by the direct and indirect forces of the mandible, has also fallen to match.
Orthotropics vs Orthodontics

It is important that you understand the difference between Orthodontics and Orthotropics:

- **Orthotropics**: This treatment aims to correct the *cause* of the problem. Facial growth and development is guided through gaining structural changes of facial and dental form as well as helping the individual to improve the posture and function of their mouth and body. Correcting the oral environment in this way, more space for the teeth and tongue is created, so that all the 32 teeth (including the wisdom teeth) align naturally, without the need for fixed braces. Improvements in facial form and architecture improves the functions associated with these structures and general health. For example, more tongue space creates a larger airway, which can dramatically improve sleep apnoea. The therapy requires hard work and dedication but if successful, the dental and facial changes can be profound and permanent.

- **Orthodontics**: Traditional fixed braces aim to push the teeth into alignment mechanically and sometimes requires surgery to correct significant discrepancies, effectively treating the *symptoms*. Frequently orthodontics requires the extraction of teeth and rarely leaves space for wisdom teeth, meaning that 4 or 8 permanent teeth are lost. There is a significant risk that the mechanics retract the dentition and the face, worsening the underlying problem, often negatively affecting the airway. After treatment with fixed braces, permanent lifelong retention is normally required. There is growing evidence permanent retention is damaging to the gingiva and bone which supports the teeth through holding them out of their natural balanced position for long periods. Generally, this process is a passive form of treatment with little or no active input from the patient.

**Note:** Functional Orthopaedics: there are a plethora of approaches using various “functional” appliances which aim to gain similar results as Orthotropics, but are not as effective. They are usually used in combination with fixed appliances, with these associated risks, and are very different to Orthotropics.

**Tropic Premise**

The philosophy is based on the Tropic premise, which states that anyone who exhibits a number of features will have permanently well aligned teeth and good facial form. These are;

- Stand up straight (correct body and head posture)
- Establish a lip seal with nasal breathing at rest (unless talking or laughing).
- Maintain a Butterfly bite, a gentle contact or near contact between the teeth with the opening and closing muscles in balanced opposition, unless in function such as, chewing, talking or laughing.
- Rest with the tongue on the roof of the mouth, in particular the posterior 1/3. No portion should be between the teeth.
- Always swallow with the tongue on the roof of the mouth without recruiting any facial musculature (no portion between the teeth!)
- It is also an advantage to enjoy hard foods and chewing.

**Limitation of the training appliance**

A key feature of our therapy is the bio-feedback provided by the training appliance. This provides a proprioceptive feedback and trains an individual to change. A lesson learnt can be learnt forever.
This effect;
   a) Teaches the correct postural position of the mandible (usually elevating it)
   b) Improves the resting muscle tone due to the effort required to maintain this position

These effects are important and greatly beneficial; however, we have no appliances that train the function and posture of the lips or tongue. The individual must learn to train these, usually through repetitive exercise, which need supervision.

**Tongue posture and commitment**
Good tongue posture and function is possibly the most important part of the therapy, not just for the facial and oral structures, but quite possibly for head and neck posture as well. The initial phase of therapy provides more space for the tongue so that it can rest on the roof of the mouth without compromising the airway, however it is a very difficult muscle to influence.

Although we have some additional appliances to help, realistically only the individual themselves can do this. This treatment can only give someone the opportunity to change but the change itself must come from themselves.

**Motivation and commitment, team work**
It is very important that we have the whole family on board to assist with the treatment. Motivation is an essential aspect of the treatment, and there are times when any child will want to take the easy option and look for any confirmation of this through a less involved parent. One of the best ways for children to overcome the challenges of this therapy is to create a parent-child team. It is often said that a focused dedicated parent is more significant than the severity of a case.

**Myofunctional Therapy and Exercises**
Throughout the treatment functional exercises are given, often assisted by additional appliances. It is paramount the patient performs the exercises as instructed. If these are not fully enacted and learned the results can be compromised. This is essential to teach lip and tongue, function and posture, as well as building up the chewing muscle tone. To do this, we need;

- Chewing training every day, particularly in the preparatory phase of the therapy.
- Multiple functional exercises undertaken daily such as the mealtime exercise. These are recorded on a yellow card.

**Dental Alignment**
Straightening of the teeth is only secondary to the orthotrophic treatment. Its focus is to create an environment in which the individual can align their own teeth, as the other 5,400 species of mammals and our ancestors since the dawn of time till relatively recently did. Although we aim to help place the teeth into their correct position, it must be for the individual to perfect this approximate alignment. We do not recommend fixed braces, since teeth that need to be pushed into position need to be held there permanently (which is why permanent retention is necessary after fixed braces). However, we can provide additional treatment with fixed appliances or aligners if requested to gain an aesthetic dental result.

Despite this option our concern remains that teeth that need help to align are unlikely to stay
aligned and there are potential risks from being held in an artificial position for prolonged periods.

**Promises**

This therapy requires people to work hard and change. We have learnt that - despite clear and repeated warning - there is an almost universal tendency to somehow imagine that turning up and wearing the appliances as instructed is all that is required. Unfortunately, this is not the case. Initially we do prepare the grounds with some expansion and structural change, and follow with training appliances but this is to assist change, to help individuals to change themselves.

As with all methods of teaching some individuals find it easier than others. There is a clear correlation between effort and results.
Outline of Therapy

Classic orthotropic therapy, is usually carried out on 6 to 14-year old’s (sometimes older). The exact details and timeline for everyone may vary, however the underlying process is similar for everyone. Altogether the program lasts for about 36 months.

This system has been designed to assist anyone gain the maximum change possible. The harder the patient works, the greater the change. This description can only be a brief overview of the program.

The classic approach is to focus primarily on structural change, followed by postural/functional change. For many people their structure prevents normal posture and function, meaning they would struggle to make improvements and change their habits without structural change first to help them. For example, when the tongue space is severely reduced it is difficult to posture with the tongue on the roof of the mouth, as the posterior 1/3 is then extending into the airway. This is uncomfortable, and people find it difficult to rest (posture) in an uncomfortable position, particularly if the airway is compromised, for any length of time. So, some structural change is required to help people to change.

Classic Orthotropics is broken into three distinct phases:

**Phase 1: Preparation**

The preparation appliance involves arch lengthening and widening to increase tongue space this is arguably the most important element of preparatory phase of treatment.

The initial phase lasts approximately 8-12 months where we see patients every 2-3 weeks, and aims to correct the underlying structure and prepare the dental arches. During this phase patients would wear a separate upper and lower removable appliance all the time. These appliances have screws which are widened. Neck gear is also worn at night plus 2-3hrs (12hs in total). The head or neck gear is continued at night only into the training phase until good wear of these appliances is established.

This patient is comfortably demonstrating wearing his neck gear which he usually wears during the night.
Each mm of expansion increases arch width by 1mm. however, 1mm of arch lengthening provides 2mm of additional arch length. This is done by advancing the Catenary wires by approximately 1mm each visit.

The maxillary screw is turned 45° every day to provide approximately 1mm of expansion per week, actually 0.7mm. Turning the screw once a day allows a steady pressure to be exerted. An intermittent force is better than a constant force.

The lower appliance is turned 45° every other day. This is because the mandible is comprised of one single bone, unlike the maxilla which is two bones fused at the mid-palatine suture.

This first phase intentionally involves a temporary dramatic change to the dentition, whereby the front teeth are tipped forward and the upper jaw can appear to be too wide, the “ugly duckling” period. This can alarm parents, uninformed dentists and most orthodontists. However, it is expected in anticipation of the second phase and is a normal part of this treatment which will be corrected in the next phase of treatment.
The “ugly duckling” phase is apparent on this patient who has completed the preparation stage of treatment. Note the spacing and proclined anterior teeth with a widened maxilla.

The lower front teeth are frequently set back due to the position and function of the lower lip. As these teeth are moved forwards into what is effectively the functioning zone of the lower lip, we risk the integrity of the gum and bone around the teeth. This is prevented by modifications to the swallowing pattern. Therefore, it is important to change the swallowing pattern and maintain excellent hygiene to this area.

The principle aims of this phase are: -

1) Expand the upper and lower dental arches to make space for the tongue, far more than would be required for the teeth.
2) Move the maxilla up and forwards.
3) Gain a substantial increase in nasal capacity.
4) Improve the midface (the area under the eyes and either side of the nose).
5) Change the swallowing pattern

A significant increase in tongue space allows the tongue to come up out of the airway to rest and function comfortably in the palate. This usually goes hand in hand with a correction of forward head posture.

After the preparation phase, the ideal arch width should be 42mm for a girl and 44mm for a boy. Any less than 38mm tends to be unstable.

**When do we stop expanding the lower?**
This patient has completed expansion of the upper arch- the upper appliance was widened to the maximum opening of the screw. It is evident from the photographs below that they have a partial scissor bite in both right and left buccal segments. This is due to the slower expansion in the lower.
Buccal scissor bite - upper teeth sitting over the buccal aspect of the lower teeth.

As the upper appliance has been widened to the maximum opening of the screw the screw been locked into place with acrylic as pictured above.

Usually the residual scissor bite is corrected by protrusion of the mandible, additional activation of the mandibular appliance of adjustment in the training phase.

**Rapid vs. Semi-Rapid Expansion:**

The width of the PDL is 1/8mm. Opening the screw at a rate of 1/8mm only reduces the space for the membrane on either side by ½ mm leaving viable vascularisation, thus little damage of surrounding structures occurs.

Conventional ‘rapid’ expansion opens the screw by ¼ of a turn or more, and therefore crushes the membrane of the PDL on each side flat therefore completely reduces the blood supply. This is thought to lead to necrosis of the bone as well as root resorption.

Semi-rapid expansion gains the benefits of rapid expansion but without the damage. Bone can only grow at a maximum rate of 0.5mm a week. Semi-rapid expansion expands the bone at 1mm/week (or slightly less) with bone growing from both the right and left side at a rate of 0.5mm/week. Therefore, there is no damage caused with very little tipping of the teeth.

On the other hand, during rapid expansion, the mid-palatal suture opens and is filled with ‘black space’. Radiographically this area will appear radiopaque hence the term black space. Bone is unable to grow at a fast-enough rate to fill this black space and therefore it fills in with scar tissue. It takes a long time, around 6 months, for scar tissue to be replaced with bone and therefore relapse is very high in cases with rapid expansion as there is very little stability of bone. In the case of semi-rapid
expansion, because collagen can fill in at the same rate as expansion, there is no radiopaque ‘black space’ visible and conventional orthodontists will argue that no expansion has occurred.

Over time, it may appear that the resultant expansion from the semi-rapid phase may relapse. However, this is not true relapse but simply the inward tilting of the teeth.

Once adequate expansion has been gained, the patient will then need to move onto the training appliance to train them to keep their mouths closed.

**Phase 2: Training**
The second phase of treatment is the most important. It lasts for about 16-20 months but could extend indefinitely for someone who is unable to change.

We aim to gain changes in posture and behavior, specifically changing the postural position of the mandible and raising the resting muscle tone. This phase makes use of a biofeedback mechanism. In Phase 1 the appliances do the work, in this phase (Phase 2) the individual does most of the work themselves. This is possibly the most difficult phase of the treatment and one that requires good commitment over a prolonged period. There are bound to be tears and problems during this period and some “tough loving” is needed from parents. Without good wear, which we will be timing, the treatment does not work. Some patients will not be able to achieve this which will prolong treatment and our costs, leading to additional fees and at times termination of therapy.

The training appliance is largely passive, its main feature is to remind the wearer to hold the lower jaw in a predetermined position. It is very important that this appliance is worn for most of the day 18-22hrs.
**Soft locks:**

The purpose of the locks is to engage in soft tissue undercuts of the lingual sulcus to create a feedback loop to raise the habitual mandibular postural position and raise 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 fangs 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 open in hinge axis slowly until they first engage, making initial contact with the soft tissue. This allows us to view the freedom of motion before the fangs 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 fangs 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-oraly where they touch on opening.

Once the locks contact soft tissue, the patient must stop dropping. A measurement is made of the distance between this position and the closed position 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.

**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.

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 anterior outside limit 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:**

This is the most recent soft lock modification which proved successful in engaging soft tissue undercuts adjacent to the lower distal molar. Having gradually added on to anterior locks, certain patients were returning with L-infinity (L-) 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 retro mylohyoid 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 with adequately wide mandibles and causes far less trauma, perhaps due to the increased mobility of the soft tissue in this region.
If the appliance is ever uncomfortable in the morning it should not be worn the next night. To compensate for this, patients should wear it during the day to make up hours. The patient should never just stop wearing the appliance.

The front teeth will only upright into the correct position once the patient has established how to maintain a natural lip seal. We resist artificially correcting their angulation as gaining and maintaining this unnatural position can have a negative effect on the teeth and gums.

Together the first two phases last approximately two years, however this is very dependent on the cooperation and response of the individual. At times some individuals take longer despite excellent co-operation, some people find it easier to change or learn than others. However, there is a clear correlation between effort and results.

**Phase 3: Active retention**

We highly recommend several years of active retention following the training phase. During this time an appliance is worn at nights only and visits are more occasional, approximately every 3 months. It is usually recommended that this phase lasts until the end of growth plus 1 or 2 years.

It is important to remember that after conventional orthodontics patients are asked to wear a retainer for the rest of their lives. For some people this may be recommended after the hybrid orthotropic therapy; it depends on how much people change.

During this phase we at times recommend additional training appliances with exercises to correct swallowing patterns.

Once the structural changes have been made there is a progressive cumulative effect from the appliance every night. We estimate that we are gaining almost 50% of the improvement in this period with a constant low level of bio-feedback for many years. This allows the training, the new postural and functional habits to become deeply ingrained into the sub-consciousness and maximize the chance of a permanent change.

It is important the patient continues with the additional elements and therapies to prevent them reverting which would lead to relapse.
Diagnosis- Reading the face

It is important to have a good understanding on the way facial structure is affected by the action of facial muscles as well as any postural habits. This will allow you to determine the prognosis of treatment. Success will only be gained if the patient is willing and able to correct any poor habits and muscular activity.

**Lips:**
The lips are a good indicator of the level of crowding. The table below shows the relationship between the resting position of the lips and the level of crowding.

<table>
<thead>
<tr>
<th>Lips at rest</th>
<th>Crowding</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sealed</td>
<td>Stable- none/little crowding</td>
</tr>
<tr>
<td>Up to 4mm apart</td>
<td>Slight crowding</td>
</tr>
<tr>
<td>&gt;4mm apart</td>
<td>Upper and lower will be crowded</td>
</tr>
<tr>
<td>&gt;8mm apart</td>
<td>Severe crowding + unattractive face</td>
</tr>
</tbody>
</table>

➢ Those who experience a blocked nose will tend to keep their lips apart most of the time and this is usually combined with a head tilt of around $10^\circ$ to help maintain the airway.
➢ The lips can also change shape if the seal is compromised:
  - lower lip can become enlarged
  - lower lip is in front of/ larger than upper lip when viewed in side profile

**Upper Indicator line:**
This is the distance between the tip of the nose to the edge of the upper LEFT incisor and gives an indication of the position of the maxilla.

The ideal upper indicator line = 28mm at age 5 and should increase 1mm each year until puberty.

At puberty the average should be:  
<table>
<thead>
<tr>
<th></th>
<th>Boy</th>
<th>Girl</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>38mm</td>
<td>36mm</td>
</tr>
</tbody>
</table>

This patient has a particularly high upper indicator line

Quick guide:  
- Boys $\rightarrow$ add 23 to age  
- Girls $\rightarrow$ add 21 to age
Lower indicator line:
An increased lower indicator line *usually* indicates a deep bite

When taking the lower indicator reading, turn the dial calliper away from you when measuring the lower indicator line to avoid skewing results.

➢ Proclining the lower incisors will help correct the lower indicator line
➢ Long lower lips are indicative of an overactive mentalis muscle → Hoffman wires used to relieve this muscle.

Cheek line:
This line runs down from the centre of the eyeball to where it touches soft tissue.

- Ideal → parallel to the nose
- 30º cheek line → (in relation to bridge of nose) nose will appear hooked

Eyes:
- Bringing the maxilla forward will support the eyes better and therefore less of the sclera (white of the eye) will be visible is the maxilla is brought forwards and upwards
- The maxilla also supports the outer canthus of the eye and a backward positioned maxilla can cause the eyes to appear droopy/sleepy.
**Muscle Bulges:**

- Enlarged orbicularis oris muscles due to *tongue between teeth swallow* as pictured below

![Muscle Bulges](image)

**Tongue:**

- Scalloped tongue: due to teeth pushing on tongue for long periods of time. This also results in a collapse of both arches