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Structural Misalignment: its Effect on Performance

Angela Caine AGSM LRAM
The Voice Workshop
436 Winchester Road
Southampton SO16 7DH

Introduction

There is already considerable evidence in the literature to show that temporomandibular dysfunction (TMD) causes stresses throughout the whole body. Although a number of publications have linked TMD with the performance problems of instrumentalists (see Taddey, 1992) there has been only one previous publication linking TMD with voice problems (Amorino & Taddey, 1994). This is surprising considering the coordination required between the jaw and he vocal mechanism during breathing, speech and singing. Interdisciplinary work among clinicians is relatively new and links between TMD and the voice are only just beginning to be considered. The author's own experience of TMD and voice problems, which neither the medical or music profession could correct, indicated that links between jaw problems and voice problems are reflected in the alignment or misalignment of the whole body (Caine, 1993). The author, a chiropractor and a dentist have now begun a multidisciplinary pilot study in Southampton to demonstrate the effect that structural imbalance and misalignment has on performance and to investigate diagnostic and treatment protocols.

Background

Temporomandibular Dysfunction (TMD)

The mandible or jaw has three planes of movement, involving sliding movements in the joints. It has to move very precisely to chew food without traumatising the teeth. It also has close association with the functional activity of the pharynx, larynx and skeletal and muscle systems of the neck (Kawamura 1968). Owing to its complex nature, mandibular movement requires close central nervous system control at all levels. Relatively large proportions of the higher centres and the brain stem are concerned with this task (Penfield and Rasmussen, 1950).

Some 50 years ago Fonder (see Fonder, 1987, 1990) began formulating what he eventually called 'The Dental Distress Syndrome'. He noticed that when people were restored to full dental health many apparently unrelated symptoms and pains disappeared. At first Fonder assumed that this was because he was bestowing "tender loving care" upon his patients as well as attention to dental detail, but then he himself suffered pain in the neck, head and back and realised that it was connected to his jaw. He then joined the Dental Research Group of Chicago which was concerned with the relationship between dentistry and general health (Guzay, 1980). This group discovered that when the muscles attached to the mandible do not function symmetrically this imbalance upsets the posturing of the cervical vertebrae, particularly C1 and C2. The function of the jaw and its related systems is so important that head, neck and face symmetry is soon lost in the presence of TMD, as shown in Figure 1.

All the leading music colleges and specialist schools in the UK offer *Alexander Technique* as a training in the re-education of habitual patterns of use (Alexander, 1932). Alexander's "theory of primary control" states that freeing the neck stimulates the postural reflex in such a way that it encourages both poise and an upright, balanced posture in the whole body. An unfree neck, according to Alexander, is one in which there is a dysfunction at the atlanto-occipital joint, resulting

in the malposturing of the cervical vertebrae, particularly C1 and C2, and their relative muscle systems. A literature search indicated that distinguished clinicians in other disciplines had also linked structural dysfunction with collapse of the cervical vertebrae and its concomitant problems. The basic underlying cause of a problem is often unrecognised if it lies outside the area of expertise of the examining physician and there is no mention of the dentition in the writings of Alexander. Dentally related atlanto-occipital problems were not recognised by him. If the dysfunction of the mandible in its relationship with the cranium could affect the muscle tonus in the area of C1-C2, the freeing of the neck, and the poise and balance of the whole body, might require dental assistance as well as re-education of habitual patterns of use if the improvements were to be permanent.

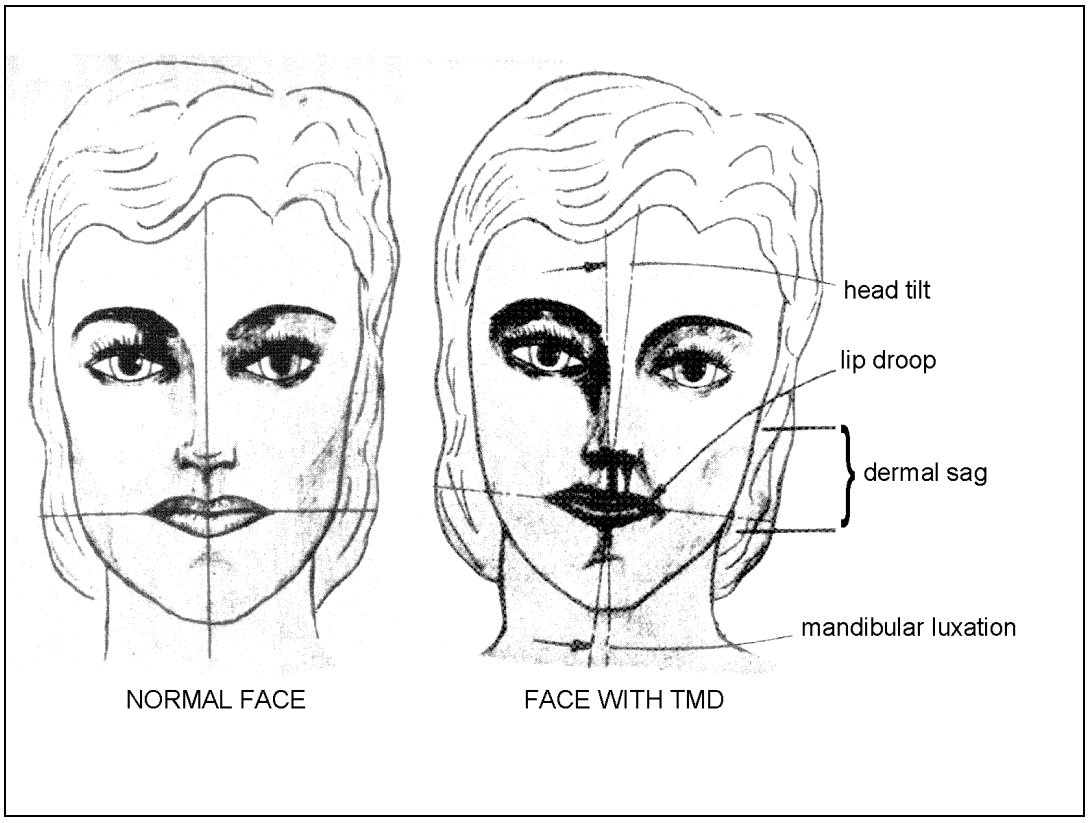

Figure 1. Visual aspects of temporomandibular dysfunction (TMD), after Guzay (1980).

Malocclusion

Malocclusion, or the incorrect meeting of upper and lower teeth, is a common cause of TMD. Although malocclusion appeared as a dental problem around 1940, it was Fonder (1977) who first alerted dentists to the potential damage and stress which they could inflict upon the vascular, skeletal and neural structures throughout the body by aligning teeth for a beautiful smile without consideration for function or skeletal alignment. The resultant problems included not only previously researched physiological symptoms (e.g. neck and shoulder pain, lower back pain, headaches, numbness or tingling in fingers and feet) but also emotional and psychological symptoms (e.g. worrying, nervousness, forgetfulness and a feeling of failure). The next wave of dental pioneers refined treatments and began training programmes to alert the dental profession to the significance of the stress to homeostasis of the whole body when the jaw joints were misaligned. Musicians may have to consider that lack of coordination between right and left hands may well be corrected more easily by the dentist than a music teacher. A child with an occlusion as in Figure 2 (mid or lower) will require dental correction before playing any instrument, not just the ones that rest against the teeth. Learning to play an instrument with this bite pattern is laying down "software" in the brain which already includes stress factors.

The Role of the Tongue in Structural Misalignment

There is agreement in dental and orthodontic literature that the natural resting position of the tongue is one in which the upper surface of the visible tongue lies against and acquires the shape of, the maxilla. The front of the tongue should lie just behind the alveolar ridge, just behind but away from the front teeth (Rocabado *et al*, 1983**;** Mew, 1981). This resting position facilitates efficient breathing, swallowing, eustachian tube evacuation, and function of the whole upper respiratory tract. Clinicians are also agreed that the fundamental breathing system is nose breathing, mouth breathing being supplementary and not an alternative system. In its natural resting position the tongue can make a seal with the soft palate which allows the continuation of nose breathing when the mouth is open (Caine 1997).

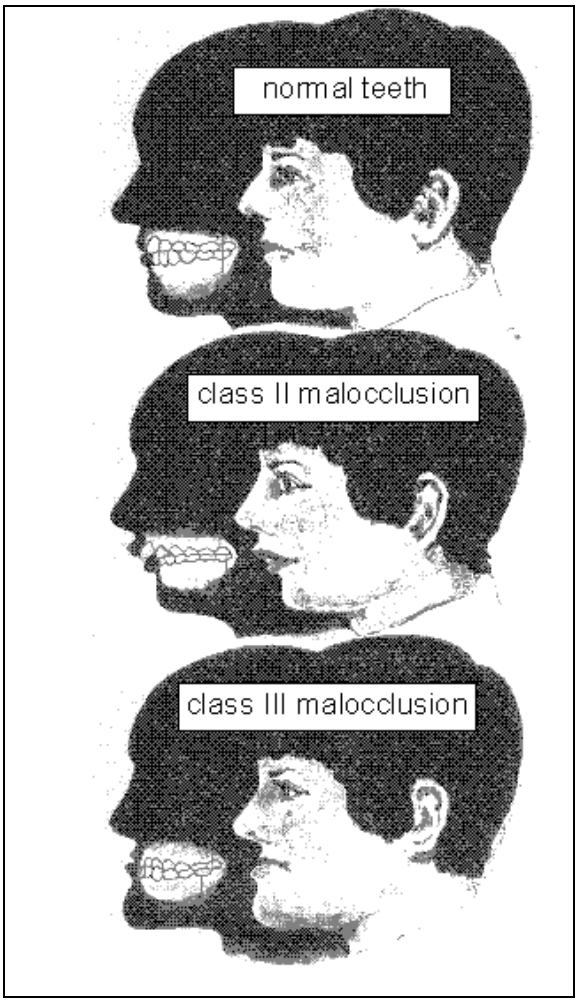

Figure 2. Visual aspects of malocclusion.

In chewing the tongue coordinates with jaw movement. It moves forward and down to push food between the teeth and keep it there. Breathing, speech and singing, on the other hand, rely on the excursion of the hyoid bone and the tongue needs to coordinate with the pharynx and with this movement. During the last 500,000 years the development of sophisticated vocal communication has superseded the tearing and chewing of food. Crelin (1972) built a rubber duplicate of an adult human vocal tract and discovered that all the vowels sounds are most efficiently formed in the pharynx by the back of the tongue. The muscle which postures the tongue into its natural resting position inserts into the styloid process of the skull, which is also the attachment for the suspension of the larynx. The strengthening of this muscle gives priority for back of the tongue articulation of vowels (Caine 1991).

The tongue rises out of the hyoid bone, which is the attachment for the intrinsic suspension system of the larynx. The hyoid bone is suspended from the skull on each side by the stylo-hyoid ligament. Anterior/posterior and lateral stabilisation is carried out by digastricus and omohyoid respectively. These muscles also form part of the laryngeal extrinsic frame (Demarest & Fink, 1978). The extrinsic frame assists in regulation of the vocal folds (Zenker & Zenker, 1960; Sonninen, 1968). The digastric muscles, left and right, lose symmetry in TMD, thus unbalancing the hyoid bone and causing spasm in the intrinsic suspension system. It follows that dysfunction and resultant distress at the mandible can follow this muscular pathway to vocal fold dysfunction and the result will be vocal distress.

The role of the Chiropractor and the Osteopath

The Pelvis

If it is accepted that our fundamental life support system is breathing and that the voice is an integral part of that breathing system, it follows that anything which upsets breathing will also affect the voice. The pelvis is the weight bearing, and also weight distributing, area of the body. Two strong joints between pelvis and sacrum (the sacro-illiac joints) stabilise this whole system. If damage destabilises one of these joints, weight bearing and therefore the whole postural balance will have to change to compensate for it. Leg flexing muscles will lose their symmetry and it will become difficult to distribute weight equally between the two feet. Once the pelvis goes out of alignment the body will increasingly adapt to the unbalanced situation. However there is a finite limit to the range of adaptation (Howat, 1997). The end of adaptive range is signalled by pain: the body's danger signal.

Two major leg flexor muscles insert into the diaphragm (Gray, 1977). Any asymmetrical contraction in these muscles, in an effort to right a postural imbalance, will restrict the contraction of the diaphragm. This will restrict the breathing, and consequently, also the voice. In fact the voice can often be used as a diagnostic tool to signal structural misalignment of the pelvis before the onset of pain and pathology (Caine 1997).

The Cranium

According to the 1977 U.S. edition of Gray's Anatomy (Gray, 1977) "The skull is composed of a series of flattened or irregular shaped bones which, with one exception (the lower jaw) are immovably joined together". Sutherland first questioned the fused skull in 1899 but like the rest of the structural pioneers he was in an age set on developing the body's response to chemistry not engineering. Since then, the movement in cranial sutures has been extensively researched (Upledger, 1983; Frymann, 1971; Sutherland, 1990). The pumping action of the fluid which bathes the brain and spinal cord moves the bones of the skull rhythmically, providing a fundamental corrective force within our endowed self-righting mechanism. TMD can cause some of the cranial sutures to become fixed, thus inhibiting the cranial-sacral pump.

The chiropractor will introduce wedge shaped blocks under the pelvis while lying down to allow the body to seek its own correct balance and alignment. Gentle manipulation of the cranium restores symmetrical rhythm in skull movement. Chiropractic or osteopathy can return the body to symmetrical function well within adaptive range. The dentist must make sure that DDS does not interfere with this process.

What is Stress?

"Performance Stress", according to the literature, is mainly attributed to the dysfunction of psyche and not soma. Selye (1976) describes stress as the "non-specific response of the body to any demand". Stress is necessary. Good stress, which Selye refers to as "*eu*stress" produces a healing, stimulating response because demand remains within the adaptive capacity of the body. If, however, demand exceeds adaptive capacity by being too great or too sustained or both, it produces "*dis*tress" Selye provided the following time course for the three principle stages of distress:

- *Alarm Reaction (which cannot be sustained for long by the body)*
- *Stage of Resistance*
- *Stage of exhaustion.*

While *eu*stress is stimulating and regenerative, *dis*tress is debilitating and degenerative. Both are accumulative. For example, two musicians enter a competition. One is pacing the competition easily. The other performs just as well but is actually at the end of adaptive range. Both appear to be performing at the same standard in round one and both are selected for the second heat.

The higher standard stimulates the first competitor but causes an alarm reaction in the second. The second heat stimulates the first competitor to play better than ever. Extra effort is the only technique available to the second competitor who applies extra effort and practice time in an increasingly stressful cycle. The second competitor does not win. Constant repetition of this cycle of *di*stress sets up patterns of resistance within which performance could actually deteriorate as practice time and effort increases.

Selye called this *di*stress cycle 'General Adaptive Syndrome' (GAS). Fonder's Dental Distress Syndrome (DDS) (Fonder 1990) suggests that malocclusion and TMD intensify GAS, but more importantly where GAS is relieved by sleep, DDS is a 24 hour stress because of the involvement of the teeth. Almost half of both sensory and motor aspects of the brain are devoted to the "dental area" (Penfield and Rasmussen, 1950).

The Effects of Structural Correction

Interdisciplinary work was first started to attempt to improve the voice of a singer, who had obvious TMD problems, by structural correction and to monitor this correction through any changes in performance.

Treatment Mark 1 and Mistakes

Case Study 1

Singer, age 53 with years of vain searching for answers to recurring voice loss and its concomitant problems of emotional stress and instability. She was a voice and *Alexander* teacher, with AGSM in piano and LRAM in singing. She had studied at Guildhall and won a scholarship to fund a fourth year to study opera. She had began a promising professional career with complete confidence in her own ability.

Problem

Her voice lost resonance, rhythm and pitch range gradually from age 20 to age thirty, when it ceased to be a quality voice. Laryngologists, singing teachers and other voice specialists failed to discover the problem, which was finally attributed to "age".

Assessment

Dental assessment revealed a severe cross-bite (the jaw pulled over to the right). Supporting molar teeth had been extracted causing spasm in neck muscles and asymmetry in the vocal suspension. All wisdom teeth had been removed under general anaesthetic at age 20. By her late 30s all adaptive range had been exhausted.

Treatment

Unsure of where to begin we began by correcting the jaw, which was the most obvious problem. Impressions were taken and a removable acrylic orthotic (dental splint) was fitted to realign the jaw, open up a locked joint on the right and provide molar support where teeth were missing. *Alexander* work was continued throughout the occlusal correction with lessons from a STAT registered *Alexander* Teacher.

Short Term Result

Breathing improved and long phrases became easier to sing. Vocal range extended, but the mix of upper and lower harmonics in the voice did not change. The voice did not become lovelier. There was a change in body shape towards thinner and taller, which was attributed to the release of tension in supra and infra hyoid muscle systems. Some consonants were reduced to spitting and hissing for a while, but the tongue re-postured relative to the new reference very quickly. The change in tongue posture increased efficiency in both breathing and articulation for singing. The effects of the treatment were observed for one year, meanwhile reporting these observations to Cranio Group, an International Society for the Study of Craniomandibular Disorders. This group includes chiropractors, dentists, orthodontists, osteopaths and other clinical disciplines with this interest. The aim was to collect as much experience as possible so as to find a way to proceed after the first year, for which there was no existing protocol.

Result of TMD correction

The obvious is not always the right thing to do, but you have to start somewhere. At the end of the year the subject sustained major physical collapse through the slipping of the right sacro illiac joint. This was experienced as chronic pain in walking, a shorter right leg and subsequent limp, a raised right shoulder, reduced facility in playing the piano and major reduction of resonance and range on the voice. Dental correction was halted while the whole interdisciplinary programme was reviewed. Chiropractic assessment now diagnosed a Category II skeletal misalignment (see Figure 3). The dentist and the *Alexander* teacher had concentrated on the delicate controlling mechanisms of the central nervous system and assumed that all imbalances would realign accordingly. The pelvis had not had a corrective input. We had been too clever, too cerebral, and not taken sufficient account of the simple laws of engineering. The displacement of the jaw in one direction is balanced by the equal and opposite imbalance of the pelvis in the opposite direction. However, pelvic integrity is maintained by ligaments; connective tissue not controlled by the central nervous system. It was apparent that correction should have begun with gross anatomy and then moved on to the more refined systems.

Treatment Mark 2 and Correction

Chiropractic treatment was continued for two years on the above singer to stabilise the pelvis before any new dental work was attempted. After this period, light wire dental appliances were fitted on top and bottom teeth to correct the cross-bite and its concomitant muscle problems (Jecman, 1995).

Results so far

The pelvis is now stable and the first professional concert for thirty five years has been made possible by wearing a light wire dental appliance to guide the opening and closing of the jaw and maintain the integrity of the whole head and neck musculature. An elastic spring has now been fitted between upper and lower teeth on the left to correct a torsion in the cranium. The result of

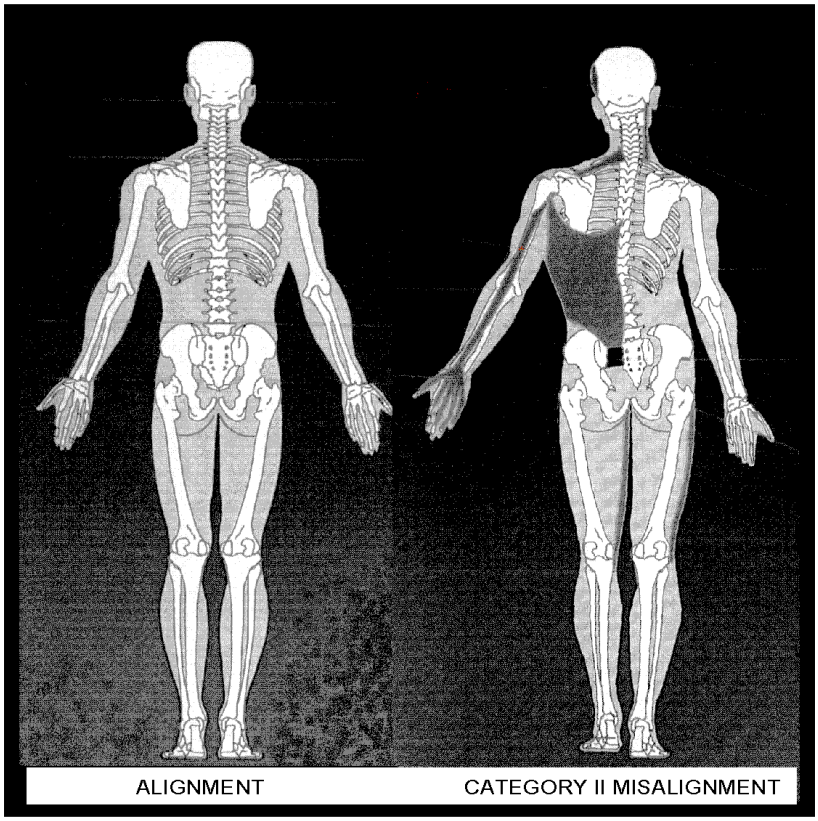

Figure 3. Structural imbalance, after Howat (© Cranial Communication Systems).

wearing this light wire appliance for three months is that the maxilla has expanded and all the teeth have erupted. The bottom teeth have also straightened. Facial symmetry is re-established and the voice is now free. There is now sufficiently improved finger and arm facility to again play the piano repertoire which was once prepared for an AGSM, and improvisation skills have returned.

Putting it all Together: An Interdisciplinary Study

Following the initial investigation, reported above, a pilot study has been started in Southampton with the aim of establishing protocols for the diagnosis and treatment of structurally related voice problems. The study began with a volunteer student of singing with voice problems which were so severe that she was determined to try anything. Ten musicians are now at various stages of treatment. Although most of them are singers, the observed improvements in balance, flexibility, breathing and confidence are also relevant to instrumentalists.

Case study 2

Music student (singing), age 21. She had a promising beginning to a University performance course and was charismatic on the platform. There was a gradual deterioration in both the voice and her exam results over three years. The voice "tightened" over this period and she failed the performance part of her degree. She became very stressed and suffered frequent bouts of flu and laryngitis.

Assessment

A cross bite and inefficient seal between tongue and soft palate caused a slight speech defect on "s". She had a very narrow maxilla: four premolars had been removed at age 12 for crowded teeth. She was assessed by the chiropractor as a category II with a cranial misalignment (see Figure 3).

Treatment

The pelvis was stabilised with chiropractic treatment before any dental work was begun. She was regularly recorded on video. There was no physical collapse. After Graduation she stayed in Southampton for a year, during which time voice and *Alexander* work were introduced and an appliance fitted to widen the maxilla. This appliance fitted across the roof of the mouth and she expanded it once a week by turning a screw.

Result after12 months

The voice improved, but she left the area and treatment had to be abandoned. However, she was having problems of exhaustion and depression while wearing the appliance. On all the subsequent subjects only light wire appliances were used: these do not cover the roof of the mouth nor interfere with cranial sacral rhythm (Jecman, 1995). They are regularly adjusted by the dentist who therefore has control of the speed of movement in the bone and teeth.

Case Study 3

Singer, age 27. She had been offered a scholarship to the Royal College of Music, but decided to train at Guildhall as a performer after winning a county music award for singing. She had received advanced ballet training and gained Grade 8 piano. Glandular fever took her out of college for a year but she returned to obtain GGSM with qualification to teach singing.

Problem

The voice was getting smaller and thinner; limited in range and unrhythmic. She could not open her mouth very far and pitch range was gradually decreasing. She experienced jaw pain and clicking joints. She could only sing at all with great effort and constantly ran out of breath. She had no confidence in her voice or in her musical ability and apologised all the time.

Assessment

The maxilla was too narrow for a natural tongue resting position, having had four premolars removed at age 12. Her articulation had been programmed with the tongue lying in the floor of the mouth. She was assessed by the chiropractor as a category II.

Treatment

The pelvis was stabilised, bringing an immediate improvement to the breathing.

Her tongue was reprogrammed using exercises (see Caine, 1991) to prioritise vowels, stretch ligaments and relieve jaw pain. She was fitted with a light wire appliance to widen the maxilla.

Results after 2 years

Her tongue is now resting against roof of her mouth. The back of her mouth opens wider and the jaw pain has gone. Her face shape has changed from long and doleful to smiling with muscles well toned. The range and resonance of the voice has extended. She now sings across an octave and a half without effort and her range is expected to extend further with continued maxilliary widening.

Case study 4

Singer in a successful Folk Rock Band, age 46. She had been a successful and popular folk singer for 25 years. Over the last two years she had suffered a gradual reduction in range and resonance of the voice until the pitch had to be lowered in all her material. Her performance "charisma" depended to a large extent upon dancing into the audience at the end of a performance: this was no longer possible due to stiffness and being out of breath. Her performance became static and untypical.

Assessment

Her pelvis was found to be out of alignment, probably due to the birth of her children who were now 15 and 13: most people have an adaptive range lasting about 15 years. The sacro-illiac joints move in the birth process and may not realign symmetrically. This was not diagnosed at the time as it is not established antenatal practice to check for this. There was no apparent dental problem.

Treatment

The pelvis was realigned. Breathing was improved by tongue and rhythm exercises. Public performance had to be maintained while simultaneously correcting serious performance problems. She had developed a very strong compensatory muscle system to cope with the previous two years. She began an immediate daily exercise programme which is reviewed regularly.

Results after $2^{1}/_{2}$ years

The original performance energy has been regained. Pitch is gradually returning to normal. She is now dancing again.

Case study 5

Actress, age not specified. She has a one woman show and is also a regular reader of *all* the small parts in radio plays and audio tapes.

Problem

She suffered recurring voice loss. An increasing limitation in flexibility of dialect and accent was seriously endangering her living.

Assessment

There was spasm in the suspensory muscles of the larynx. Extensive cosmetic dental work in 1995 had created a malocclusion and a deviation in the opening of the jaw. Four months later she began having voice problems. Her pelvis was unstable.

Treatment

The pelvis was stabilised by a Cranio Group osteopath in her area and her dentist was persuaded to grind the fitted crowns into a balanced occlusion.

Results after 2 months

The problem had been precipitated rapidly and she had immediately done something about it. She used her voice very well and had obviously always done so. When she felt her voice was not right she immediately sought help. The problem was therefore new, clear and not compounded by compensation for it. The corrected alignment immediately corrected the voice problem. She now has a regular six-monthly maintenance checkup with the osteopath.

Case study 6

Counter tenor, age 27. He had an illustrious career as a chorister, winning the RSCM St Nicholas Award. After University he worked extensively as a counter tenor with five different choirs. He is a biology teacher in a private school.

Problem
He had recurring voice loss, tightness in the chest, limited range and discomfort which has increased over the last four years.
He found it difficult to make anyone take his voice problem seriously because he is not a professional singer.
Assessment
He had a very narrow palate following the removal of four premolar teeth. His tongue rested in the floor of the mouth. He did not correctly understand the mechanics of the tongue, the soft palate, the face muscles and the breathing. He still sang like a treble. He had a TMD problem and an unstable pelvis. The two temporal bones of his cranium were seriously out of alignment.
Treatment
A "Cranio Group" chiropractor near his home stabilised the pelvis. He then returned to the *Voice Workshop* to re-educate his tongue and face muscles to assist cranial treatment to align his temporal bones. When a good state of cranial symmetry is achieved a dentist working with the chiropractor will fit a light wire appliance to realign his jaw and expand the maxilla.
Results after 4 months
His pelvis is now stable. His singing is getting stronger and has gained pitch and resonance. He has been taught how to roll on the floor while singing to reduce vocal effort and loosen his "choirboy legs".

Case study 7
Music student, age 21. He had been a choir-boy treble in his Prep and Public School choirs until he was 14. He has an AB grade 8 with distinction in double bass. He played leading roles in National Youth Music Theatre from age 16 to 18 and applied to Cardiff college, which specialised in the teaching of singing.
Problem
The tenor voice disappeared at 19 after a cycle of voice loss, rest and recovery and was unable to manage the Cardiff audition. He gained entry to the Department of Music at the University of Southampton as a Double Bass player and learned about our pilot study. He could no longer sing at all.
Assessment
He had a narrow maxilla, the arch of upper teeth fitting inside the lower teeth: the premolars had been removed at age 10 for overcrowding and several years of orthodontic work had been carried out to even his smile. He swayed to sing. He had very small teeth and was a mouth breather due to inefficient face muscles and poor tongue posture.
Treatment
His pelvis was stabilised by the chiropractor. His tongue was re-programmed to increase breathing efficiency and exercises using a centring board helped him to relearn how to balance symmetrically (Caine, 1991). Light wire orthotics were fitted which did not cross the maxillary midline and an elastic pull was introduced between upper and lower teeth on one side to correct a torsion in his cranium.
Result so far after 15 months chiropractic treatment, 5 months with a dental appliance and 18 months of singing lessons. The tenor voice has returned. After audition he has now been accepted on the performance course at Southampton as a singer. He will perform in his first recital in three months time, wearing the light wire appliance. The maxilla has widened to change his whole face shape and all of the upper teeth have wide gaps. Work will begin soon to move the teeth into place and the extraction spaces will be bridged. Voice range and resonance are increasing in direct relation to the maxillary widening and re-programming of the tongue and articulation.

Case study 8
Music Student, age 19. She had AB grade 8 in singing and a grade 8 in piano. She is a former member of the National Youth Chamber Choir of Great Britain, completing two world tours between ages 16 and 18.
Problem
The voice lacked pitch range and resonance. No matter how hard she practiced, her voice was breathy and did not develop any personal qualities. The only available pitch was very low, and

with her good sight reading and ability to hold a vocal line she was always made to sing alto. On auditioning for singing lessons at age 17 she had been declared to be a contralto and trained as such. She did not feel that this was her natural voice.

Assessment

Contralto was definitely not her natural voice. The pressure required to produce it was now causing huskiness in both speech and singing. She had her premolars removed at 12 and then had three years of a fixed brace which crossed the roof of her mouth. An excessively narrow maxilla and difficulty with balancing indicated a pelvic and cranial misalignment, particularly as she always fell off a balance board (Caine, 1991) to the right.

Treatment

It was difficult for her parents to accept the assessment since she had gained two advanced music certificates and a place on a University degree course in music. They were given relevant information and then could see that their daughter was not improving musically, however hard she worked. Treatment will begin during this semester. The voice will be carefully maintained *well* within adaptive range until a treatment protocol can be set up.

Case study 9

Music student, age 20. She had joined her first choir at age 5. She was later a member of the Berkshire, and subsequently the National Youth Choir. She has an AB grade 8 in singing and in voice, and grade 5 in piano. She is currently in her third year at the University of Southampton on a combined honours course in music and English.

Problem

When videoed in recital it was very obvious that she could only sing while leaning to the right, swaying to the left in between phrases. She tried to correct this, but was not able to. Throughout her first two years she continually contracted tonsillitis. By monitoring the attacks it became apparent that they occurred before performances and examinations. She sang in very short phrases, which prevented good performance as a soloist, although this was not obvious in choir.

Assessment

One leg was shorter than the other due to a tipped pelvis and her posture was quite stooped. Her chiropractic assessment was category II. Her premolars had been removed at age 12 and her maxilla was excessively narrow. The tongue was resting in the floor of the mouth. Her breathing was inefficient, and all through the mouth. The whole facial bone structure was under-developed for singing.

Treatment

A year elapsed between initial assessment and commencement of treatment. She thought treatment was risky and nothing to do with the voice. However, recurring illness during her final year encouraged her to "try anything once". Chiropractic treatment is now stabilising the pelvis and tongue exercises are reprogramming articulation and strengthening face muscles.

Results after 6 months work, following 1 year for consideration

There has been no more tonsillitis. Breathing for singing has improved. The voice is more resonant and sounds more mature. A more natural tongue resting position has been established. She can now stand still and sing. The final recital for her degree assessment is in June. She has a long way to go before she will sing as she should, but she is not ill any more.

Case study 10

Music student, age 21 with advanced performance certificates in recorder, flute and double bass. She is an all round musician and had been a member of the National Youth Choir and a county youth orchestra.

Problem.

She arrived at the University of Southampton with a diagnosed Repetitive Strain Injury (RSI) in her wrists, and a disability allowance to provide a computer for lectures on her course and a trolley to handle the double bass. She was also given "special needs" ground floor accommodation.

Assessment.

The Royal Free Hospital diagnosed RSI and provided physiotherapy and wrist supports. The University of Southampton medical centre diagnosed stress and social problems and provided counselling. The Southampton "team" diagnosed severe structural misalignment in the pelvis,

cranium and jaw. She had been misinformation about breathing, leading to hyperventilation and its concomitant problems.

Treatment.

Chiropractic treatment has realigned her pelvis and is currently realigning the cranial bones. Dental work to realign the jaw will probably be started in her third year. She had singing and *Alexander* work during her first year but cannot afford them in her second. She plans to recommence in these during year three.

Results after 2 years

The wrist supports are no longer needed. She drives a car and managed a summer job. She has created a garden out of a back yard. She is now in her second year, and is making the changes counselling advocated all through her first year but which she felt were beyond her.

Conclusions

All the subjects entered the study with structural misalignment and began to improve their performance when a corrective treatment for misalignment had been established. A useful set of tools has been assembled which have never before been used in this context. Osteopathy, Chiropractic and Dentistry usually belong to pathology, but in this case have been used to develop potential. Voice work usually belongs to development of potential and not to pathology. It was discovered that light wire appliances do not interfere with singing or articulation after a brief period for adaptation. The experience from this project is that they actually encourage a more efficient use of the face musculature and tongue. In all subjects the tongue was initially found to rest in the floor of the mouth. Their tongues had been trained by singing or voice teachers to rest in this position. In each case the resonance and range of the voice improved when the tongue was restored to its natural resting position.

None of the subjects had any knowledge of functional anatomy even when in possession of an Associated Board grade 8 performance certificate - one even had a teaching qualification. None of the subjects knew anything about the development of the voice in infancy and through childhood, and in many instances the subjects were not only operating with inaccurate mechanics but were practising very hard to maintain these inaccurate mechanics in spite of a feeling that they must be wrong.

Out of 14 music students sent to the author for singing lessons from Southampton University, eight had been found to have structural alignment problems relating to dental work in their early teens. It is common practice to remove teeth for overcrowding, especially the premolars. Removing teeth halts development of the maxilla (roof of the mouth) and prevents the tongue from achieving its natural resting position (Mew, 1981).

The actress unashamedly sought immediate help when the voice went wrong. When the singers' voices went wrong they wasted precious correction time agonizing their own musical failure. During that time they tried to hide the problem and in the process compounded it. One is compelled to question where this attitude is introduced.

This inter-disciplinary work is only just beginning. No one is completely symmetrical or perfectly balanced. This is not important if it does not interfere with life. It is more important to match demand and adaptive range. Thus while most of the population is content and safe because demand does not exceed adaptive range those who demand more precision, as in a sportsman or a musician, must develop better balance and coordination. This is not possible in the presence of misalignment, whether it be in the jaw or in the rest of the skeletal system.

"In order to advise them, I was often compelled to broaden my scientific horizons by going beyond my immediate areas of expertise."

Edmund Crelin, Professor of Anatomy, about his students at Yale.

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Angela Caine

Angela Caine began her career as a musician, studying at the Guildhall School of Music, where she was granted an scholarship to study opera. Her involvement with "structure" began in 1988 when singing teachers and voice pathologists failed to solve her own recurring loss of voice. Dental bridge work, initially for cosmetic purposes, changed her tongue reference. To her surprise, it also changed her voice. However it did not cure the problem. The realisation that there must be connections between dentition and voice began a research programme which has resulted in dentists, orthodontists, chiropractors and osteopaths considering the voice not only as a human characteristic, but also as a function which can no longer be ignored in treatment. In her capacity as a musician she teaches singing and Alexander Technique privately and for the University of Southampton Department of Music. She is on the database for the *British Performance Arts Medicine Trust*, which takes care of the problems of professional musicians and a member of *Cranio Group*, an organisation for the study of craniomandibular disorders.