Feature
Craniofacial Society: An Overview of Torticollis

Clinical Report
Deformational Plagiocephaly Associated with Ocular Torticollis: A Clinical Study and Literature Review

Clinical Counterpoint
Does Foot Position Influence Femur Position?

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Message from the President

As I reflect on my tenure on the Board and this year as Academy president, I can’t believe how fast the years have gone by. The Academy has so many active committees and task forces working through its three Councils that it is hard to believe that everything runs as smoothly and efficiently as it does.

Robert Half put it best when he said, “There’s no such thing as not enough time if you’re doing what you want to do.” I have had the pleasure of being surrounded by many individuals who are passionate about their dedication to the profession and to the Academy. They have given me a real sense of confidence each day as they all chip in to do their part to make us a great team. Many volunteer hours go into the work of the Academy—and that is what makes it such a strong membership organization.

Margaret Thatcher said, “Look at a day when you are supremely satisfied at the end. It’s not a day you lounge around doing nothing; it’s when you’ve had everything to do, and you’ve done it.” I have been blessed this year with a Board that doesn’t say what they can’t do, but rather a Board that takes pride in completing the tasks they have.

This has been an exciting year to be president of the Academy. We have increased our membership and now have reached the goal of having a full year’s operating budget in our reserve fund. Our Education Development Council (EDC) put together a high-quality, successful Annual Meeting. The Academy’s Paul E. Leimkuehler Online Learning Center (OLC) has dramatically increased its content as well as doubled the number of users downloading modules. Our Scientific Societies have again grown and are now coming to the forefront with numerous projects and presentations at our Annual Meeting.

Many of our Societies now have newsletters and have increased communication among their members. All of our Societies have established new websites. The Publications Committee developed Literature Updates to raise awareness of current research in orthotics and prosthetics outside of the Journal of Prosthetics and Orthotics (JPO). This professional resource is e-mailed to all Academy members with at least one special-interest article reviewed and highlighted.

Our Professional Issues Council (PIC) has been actively monitoring the healthcare-reform efforts through the O&P Alliance. We haven’t had all the success we wanted but will continue to work to make sure that our profession gets the recognition it deserves for the unique role it plays in the nation’s healthcare. The Chapters have become more collaborative, and good communication has been established with the Academy’s national office. The Women in O&P Committee has developed and expanded its mentoring program.

Our Research Council (RC) is continually working to move the profession forward in the area of evidence-based practice. Through our grant, we completed our ninth annual State of the Science Conference (SSC). We have also produced a new awareness video, A Future with Meaning: Making a Career of Making a Difference. This is just a sampling of the work of the Academy, the premier O&P professional organization in the world.

I have quoted Warren Buffett before and will do so again: “Someone’s sitting in the shade today because someone planted a tree a long time ago.” It was a proud moment in my life when I attended the Past Presidents’ luncheon in Chicago and had the chance to welcome the past presidents of the Academy and our sister organizations to the meeting and to recognize and thank them for seeds they planted a long time ago. I look forward to seeing how the seeds that this Board has planted blossom in the future as the Academy continues to serve its membership and this great profession. I encourage every member of this profession to donate time and/or financial resources to ensure that we always have this support mechanism ready to go.

I thank you, the Academy membership, for your great support throughout the year and look forward to seeing the continued success of the American Academy of Orthotists and Prosthetists as we move ahead in our career of making a difference. I also very much appreciate the great staff of the Academy and the Board of Directors. Mary Kay Ash once pointed out that, aerodynamically, the bumblebee shouldn’t be able to fly, but the bumblebee doesn’t know it, so it goes on flying anyway. This Board has never said, “We can’t do this,” but rather has simply flown when others may have said that it couldn’t be done.

Thank you for a great experience that I will always hold dear.
An Overview of Torticollis

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Abstract: This paper reviews the prevalence and possible causes of torticollis. The subgroups of torticollis are then differentiated, as are other noncongenital presentations of torticollis such as those caused by infections, ophthalmologic issues, or other neurological issues. Practices for stretching and alleviating the presentation of congenital muscular torticollis are then discussed, along with physical therapy goals. Surgical options are presented in the form of Z-plasty or Botox® injections to aid in stretching. Finally, orthotic options in the form of the Tubular Orthosis for Torticollis (TOT), the Fillauer Torticollis Orthosis, and the Lerman Non-Invasive Halo are compared with their relative advantages and disadvantages.

Introduction

Torticollis, sometimes referred to as “wry neck,” is a physical symptom found in all ages, in which the head laterally tilts toward the affected side and the chin elevates and turns to the opposite side.1 Because many underlying causes with different solutions may bring about this condition, a correct diagnosis must be made to successfully resolve the torticollis. The etiology of torticollis is attributable to a variety of factors including infection, ophthalmologic issues, neurological impairment, and bony malformation or muscle tightness. These congenital and developmental causes of torticollis in children have been classified as osseous, non-osseous, or neurogenic with the prevalence of non-muscular torticollis as high as 18 percent at presentation.2 Osseous causes, such as hemivertebrae, congenital scoliosis, cervical vertebrae dysfunction, occipital-cervical dysfunction, and Klippel-Feil Syndrome, are first diagnosed with a cervical-spine x-ray. These children are usually referred to an orthopedist for treatment options. In some cases, acquired torticollis may be a result of trauma to the neck causing atlantoaxial rotary subluxation, in which the two vertebrae just inferior to the skull slide with respect to each other and tear the stabilizing ligaments.3 Treatment options include a rigid collar or traction followed by immobilization. Recurrent subluxation or failed reduction requires surgical fusion.4

Neurogenic causes such as central nervous system (CNS) tumors, Arnold-Chiari malformation, and ocular torticollis are detected using pediatric neurological and ophthalmologic developmentally appropriate exams. The primary cause of ocular torticollis is cranial-nerve IV palsy that results in paresis of the superior oblique eye muscles. Ocular torticollis cannot be resolved with physical therapy as it is a neurological impairment used to maintain binocular vision.3 Diagnosed in the presence of postural changes, there are no limits to cervical range of motion. Tumors at the base of the skull can also compress the nerve supply to the neck and must be treated surgically. Other causes for acquired torticollis include infection of the posterior pharynx, ear, or ligaments secondary to adenoid surgery.3

Most cases of torticollis, which are classified as non-osseous, include congenital muscular torticollis and Sandifer syndrome, and are diagnosed with a physical exam that evaluates the range of motion (ROM) of the neck. Infants with Sandifer syndrome will develop a torticollis-type positioning of the head and neck without any tightness in the sternocleidomastoid (SCM) muscles. Infants will assume this abnormal adaptive position to reduce esophageal pain caused by gastroesophageal reflux.5,6

Congenital Muscular Torticollis

Congenital muscular torticollis (CMT) presents itself shortly after birth in roughly one in 300 births and is the third most common pediatric orthopedic diagnosis.3,1 Although the cause of CMT is unclear, it is thought that this type of torticollis is related to birth trauma, malposition in utero, or muscle trauma during a difficult delivery.3,6 This results in soft-tissue compression, leading to compartment syndrome or a unilateral fibrosis and shortening of the SCM muscle limiting ROM in rotation and lateral flexion.4,7 Clinical studies report varying conclusions on the predominance of SCM tightness in the right or left side, and predominance appears dependent on birth presentation and number of breech positions found in the study population.8 A diagnosis of CMT is usually made in the first two to three months by a pediatrician at a follow-up wellness appointment. A mass or fibrous tumor may also be palpated in the affected muscle at the age of two to four weeks.3,7 Generally, a physical examination will show the tightness of the SCM. An x-ray and ultrasound examination may also be requested to check for any further abnormalities of the neck and shoulders.7

Congenital muscular torticollis is subdivided into three groups: (1) SCM swelling or pseudo tumor, (2) SCM tightness but no tumor, and (3) postural evidence without SCM swelling of torticollis or tightness. Infants with torticollis have an 80–90.1 percent higher prevalence of plagiocephaly and development of facial deformity if the condition goes uncor
Treatment of Congenital Muscular Torticollis

Treatment plans for CMT vary with an infant’s age, severity of the torticollis, and the ability of the caregiver to follow through with recommended treatment programs. Fortunately, CMT is almost always correctable with a regimen of stretching and orthotic care in 90–95 percent of the patients. An appointment should be made with a licensed physical therapist who has experience working with infants diagnosed with torticollis within one to two weeks after noticing symmetry issues for optimal success. Acting under the supervision of a physical therapist, parents can manage a deficit of 10 degrees or less. They routinely alter the head position with exercises and positioning devices and stretching. They provide additional “tummy time” for the infant when awake. Children’s Healthcare of Atlanta has developed a regimen of “Tummy Time Tools” to promote normal development and cranial symmetry.

For more serious cases of CMT, routine therapy visits are the norm. The physical therapy goals include age-appropriate active and passive cervical and trunk ROM movements, prevention of contractures or loss of motion due to fibrosis, symmetry of face, head, and neck, development of postural reactions in all directions, and a centered upright posture of the head. The treatment plan must be incorporated into the family’s daily routine, and caregivers must be compliant and consistent in order to maximize the potential for resolution of the torticollis. The therapist will educate the caregiver on appropriate techniques for stretching the SCM, activities to facilitate better range, and positioning to improve cranial deformation. Stretching should be firm but not painful. The intensity of the stretch should be reduced slightly to avoid pain and muscle guarding. Torticollis can reappear during periods of growth, illness, teething, or as new motor functions develop. Families should continue exercises and therapeutic activities until the child is at least one year old to prevent recurrence.

Patients with a large ROM deficit or advanced age at the time of diagnosis are more likely to have a resistant torticollis that fails to resolve with just therapy. Before surgical intervention, some physicians will utilize Botox (botulinum toxin) injections. The injection improves stretching results by allowing the muscles to relax and increase in ROM. Joyce and deChalain used Botox on 15 infants with CMT who did not improve even with several months of physical therapy. Under general anesthesia, they injected Botox into the involved SCM and reported improvement in 14 out of 15 cases. They cite mild side effects such as bruising, soreness, and fever in three separate cases. There were no episodes of dysphagia or significant complications as found in Comella’s reports of increased swallowing abnormalities following Botox treatment. Joyce attributes his positive outcomes without significant complications to be a direct result of the ease and accuracy of the injection under general anesthesia. When the infant is still and not struggling, it is much easier to avoid inadvertent injection of adjacent neck muscles that lead to dysphasia.

Finally, if there is a 15-degree or more deficit after six months of therapy, the infant often undergoes surgical treatment. Various surgical techniques are available and are determined by surgeon preference and severity of the torticollis. Some of the options are unipolar or bipolar lengthening, Z-lengthening, or endoscopic resection.

Orthotic Treatment

A cranial-remolding orthosis or helmet may be used to manage the deformational plagiocephaly often associated with torticollis. The caregiver removes the helmet for specific therapy routines and then easily reapplies the helmet to meet daily usage goals. For more severe cases of CMT where stretching alone is not sufficient, an orthosis may be added to the treatment protocol. The orthotic design must manage a triaxial ROM including cervical flexion/extension, lateral flexion, and rotation.

The most common torticollis orthosis is the Tubular Orthosis for Torticollis (TOT) collar made with common polyvinylchloride (PVC) tubing. A circle of short PVC tubing is doubled and fastened behind the neck. Two short struts are placed on either side of the trapezius crest on the affected side. The TOT collar encourages the child to pull away from the collar and reduces the lateral tilt and rotated position of the head. It is
important to note that the TOT collar should be used only during waking hours under supervision and should not be used for children younger than four months of age.\textsuperscript{12,13} Cervical ranges of motion are measured without the collar and discontinued when the deficit is 5 degrees from midline.\textsuperscript{13} The TOT collar is inexpensive and easy to fit, but some users may find it difficult to adjust and “dial in” the maximum amount of stretching.\textsuperscript{12,13} A small study by Cottril-Mosterman at the British Columbia Children’s Hospital showed that infants using the TOT collar had significantly greater improvement in reducing lateral head tilt.\textsuperscript{13} Karmel-Ross also cites easy acceptance by parents and infants with no deleterious effects in a larger study.\textsuperscript{14} Most infants complete helmet therapy before being fit with a TOT collar to prevent interference and patient overload.

A second option is the Fillauer Torticollis Orthosis. It is custom molded to the child’s head and shoulder on the involved side, but it can also be constructed from measurements. A head impression is taken to maintain the position of the head and can be extended to cover the entire head to address plagiocephaly. The lower shoulder section helps anchor the device and eliminate excessive movement. The joint is designed to adjust lateral flexion, rotation, and flexion alignment when the joint is loosened and then fixated into place when tightened. This device is more expensive and requires an impression, but it allows progressive adjustment. The Fillauer Torticollis Orthosis application is more involved than the TOT collar; however, for older children and postsurgical cases it has the advantage of being able to maintain the head in any triplanar position.

A final option for orthotic treatment is a Lerman Non-Invasive Halo. After surgical release of the SCM, many physicians prescribe the non-invasive halo to immobilize the head in an overcorrected position.\textsuperscript{15} It is sized to the patient with measurements, and no casting is required. It can be adjusted as the child’s ROM increases. The device controls lateral flexion and rotation. The posterior post comes in a rigid and semi-rigid option depending on the amount of immobilization needed. For CMT, the manufacturer recommends the semi-rigid back. A retrospective study by Skaggs et al. reports on 30 children (six months to 16 years) who used a non-invasive halo after cervical surgery. Eighteen participants had a CMT diagnosis. For the CMT population, there were no complications at all. Grippi et al., using an earlier version of the non-invasive halo, reported two cases of children under four who experienced facial swelling and skin breakdown,\textsuperscript{15} but this appears to be resolved with a newer model that has breathable skin-adhering pads.\textsuperscript{16}

Summary

The physical symptom of torticollis has many root causes. Congenital muscular torticollis, one of the most common forms of torticollis, is diagnosed in the first few months of life and is caused by tightening of the sternocleidomastoid muscle. Early diagnosis of CMT and therapeutic intervention resolves the ROM restrictions in the neck for most patients. Orthotic devices for cranial deformation and residual torticollis may be necessary for more severe cases. Current clinical practice indicates the use of a molding helmet for plagiocephaly and a TOT collar for resistant torticollis. For the non-congenital forms of torticollis, usually seen in older children or postsurgical cases, orthotists use a Fillauer torticollis orthosis or a Lerman Non-Invasive Halo.

Editor’s note: Due to space restrictions, references could not be printed. References for this article are listed in the online version of this article, available at www.oandp.org/academytoday

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Conflict of Interest Statement: Gerald Stark is employed by the Fillauer Companies Inc., Chattanooga, Tennessee. The Fillauer Companies are a manufacturer of the Fillauer Torticollis Orthosis mentioned in this review.
Clinical Report

Deformational Plagiocephaly Associated With Ocular Torticollis: A Clinical Study and Literature Review


Houston, Texas, USA

The etiology of craniofacial asymmetry secondary to positional plagiocephaly with or without concomitant congenital muscular torticollis has been well established. It has been proposed that the craniofacial asymmetry secondary to congenital superior oblique palsy involves a similar etiology. The causal relationship has been thought to be a result of the adoption of certain head and neck positioning, which predisposes the infant to develop preferential resting positions during supine sleep. We present a single subject with ocular torticollis and resulting plagiocephaly, and we distinguish the resultant craniofacial findings from those seen in patients with congenital muscular torticollis-associated deformational plagiocephaly. The distinctions that exist between the resultant asymmetries observed in ocular torticollis with superior oblique palsy and those found with congenital muscular torticollis suggest that the facial hemihypoplasia observed in conjunction with ocular torticollis may be the result of gravitational forces rather than compressive forces.

Key Words: Deformational plagiocephaly, plagiocephaly, ocular torticollis

The relationship between torticollis and craniofacial asymmetries has been widely discussed in the literature. Congenital muscular torticollis (CMT), the most common form of infantile torticollis, has been specifically associated with deformational plagiocephaly and characteristic craniofacial asymmetries. Ocular torticollis is also observed with some regularity among infants and is most commonly associated with superior oblique palsy (SOP). Characteristic facial anomalies associated with SOP have likewise been well described in the literature. We present a case of an infant with congenital SOP and propose a mechanism for the associated craniofacial asymmetry observed. We conclude that the etiology of the cranial deformation is a result of external gravitational forces, distinct from those found in patients with CMT, in which the deformational plagiocephaly is secondary to the external compressive force of the infant head on a flat surface. We refer to this phenomenon as “gravitational plagiocephaly.”

Clinical Report

The patient was the product of a full-term, unremarkable delivery. The patient was reported by her parents to have had a symmetric head shape at the time of birth; however, a persistent head tilt was also observed at this time. Consistent with the American Academy of Pediatric’s “Back to Sleep” recommendation for supine positioning of infants while sleeping, the family reported that the infant consistently slept in the supine position.

At approximately 5 months of age, the family observed intermittent crossing of the infant’s left eye. The infant’s pediatrician referred her to an ophthalmologist for further evaluation at which time she was diagnosed with left congenital SOP. A family history of strabismus was also identified. Alternative patching for 1 hour per day was recommended, and the likelihood of strabismus surgery was discussed with the family. Additionally observed at this time was significant torticollis with signs of positional plagiocephaly (see Figs 1 and 2). On observation of a relative anterior placement of the infant’s right ear in relation to her left ear, the ophthalmologist referred the infant to the physical medicine and rehabilitation department for further evaluation of positional plagiocephaly.

At 7 months of age, the physical medicine and rehabilitation department confirmed the flatness of her right occipital area with a concomitant anterior shift of the right ear. A comparison of the distances measured from each exocanthion to the con-
The flattening of the occiput observed in our case subject was consistent with that seen in the presence of CMT and deformational plagiocephaly (Fig 2). However, the associated facial asymmetries observed were inconsistent with those described in patients with CMT and deformational plagiocephaly (Fig 2). In cases of muscular torticollis, one would expect several characteristic facial anomalies ipsilateral to the occipital flatness, including bossing of the ipsilateral forehead. It is almost as if the primary process in SOP is a unilateral facial growth restriction, whereas in muscular torticollis, the facial asymmetry is secondary to occipital pressure “pushing” the face forward. This is likely largely the result of the difference in facial positioning. In CMT, the child tends to look away from the head tilt, whereas in SOP, the child looks toward the tilt.

### Deformational Plagiocephaly

Multiple variations from the so-called “normocephaly” have been described in the literature. Among these is deformational plagiocephaly, also referred to as plagiocephaly without synostosis or positional plagiocephaly. These diagnoses differ from synostotic plagiocephalies in that they are not the direct result of pathologic cranial sutures, but rather secondary to abnormal pressures applied externally to the intrinsically normal infant cranium.

Several etiologies have been suggested for development of nonsynostotic plagiocephalies. Prenatal events include restrictive intrauterine positioning and/or early descent of the fetal head into the pelvis. Postnatal events are likewise positional. They may include prolonged immobilization as seen among premature infants or those with developmental delay. Asymmetric supine resting positions, whether simply habitual or secondary to muscle imbalances such as in congenital muscular torticollis, may also result in positional plagiocephaly. Not surprisingly, the prevalence of deformational plagiocephaly has increased dramatically since the American Academy of Pediatrics’ “Back to Sleep” recommendation of supine positioning, intended to reduce the incidence of sudden infant death syndrome.

Common among all etiologic factors is a predisposition toward abnormal, persistent pressures on the infant skull.
The resultant head shape when viewed superiorly can be described as a parallelogram in which there is distinct flatness of the occipital quadrant on which the weight of the head is born. Concomitant bossing or bulging on the contralateral occipital quadrant also results from the abnormal pressures created by this positioning. Ipsilateral to the occipital flatness, there is often a protrusion of the forehead. Ear asymmetry is typically observed with the ear ipsilateral to the occipital flattening and frontal bossing located anterior to the contralateral ear (see Fig 3).3,4,6,12,13

When viewed frontally, the authors have identified minor inferior displacement of the ipsilateral supraorbital rim, 14 a relatively recessed or flattened ipsilateral malar eminence,6,14,15 and ipsilateral deviation of the chin point (see Figs 4 and 5).3,14

**Congenital Muscular Torticollis**

An association between craniofacial asymmetry and CMT has been recognized since before 1890.16 Among patients with deformational plagiocephaly, the prevalence of CMT has been reported at approximately 20%.1,4 One research team, evaluating patients for both CMT and a separate, less severe presentation which they described as a “sternocleidomastoid muscle imbalance,” found that among patients being treated for deformational plagiocephaly, 76% were found to have some form of sternocleidomastoid dysfunction.17 Likewise, among patients being treated for CMT, the prevalence of craniofacial asymmetries of varying degrees was reported from 80% to 90.1%.18,19

The classic clinical picture presents in the form of a newborn with a fibrotic mass within the muscle belly of the sternocleidomastoid. The tightened SCM is often easily visualized on the affected side. Although the palpable mass in the SCM may not persist past the first 3 months of life, the restricted range of motion and resultant posturing can lead to development of ipsilateral head tilt and rotation of the chin toward the contralateral side, commonly called the “cocked robin” or wryneck deformity.20,21

The exact etiology of CMT is still unknown. Authors have suggested intrauterine constraint,22,23 muscle trauma during traumatic delivery20,21,24 and soft tissue compression leading to compartment syndrome.25 Once present, the resultant persistent head turn predisposes the infant cranium to abnormal deformational forces. In the infant sleeping supine, this equates to occipital flatness contralateral to the affected SCM with concomitant contralateral anterior ear migration and frontal bossing.17

Given the close association between CMT and deformational plagiocephaly, the similarities in their respective craniofacial asymmetries are not surprising. Those reported with respect to CMT include relative retraction of the forehead and zygoma ipsilateral to the affected sternocleidomastoid muscle, posterior–inferior displacement of the ipsilateral ear, deviation of the chin point ipsilaterally, and in advanced cases, a reduction in vertical facial height on the ipsilateral side (see Figs 6 and 7).20,26–28

**Ocular Torticollis**

In contrast to CMT, ocular torticollis refers to persistent head posturing secondary to ocular misalignment.29 Affected patients adopt abnormal head postures in attempts to optimize visual acuity or maintain binocularity.30 Among the many causes of ocular torticollis, SOP has been reported as the most common.31 Because of the tendency for the affected eye to drift medially and superiorly, patients often adopt a characteristic head posture in which the head is tilted away from the paretic side. However, in contrast to CMT in which the face turns contralateral to the tilt, patients with SOP often demonstrate a face turn to the same side as the head tilt (Figs 8 and 9).29,30

![Fig 3](image1.png) **Fig 3** Patient from Figures 1 and 2 seen in her typical resting posture prior to ocular surgery. Note head tilt and head turn contralateral to the affected left eye.

![Fig 4](image2.png) **Fig 4** Infant with moderate deformational plagiocephaly and mild congenital muscular torticollis. Note the relative protrusion of the malar eminence on the right, ipsilateral to the posterior flatness.
Like with deformational plagiocephaly and CMT, characteristic facial asymmetries have been reported in association with ocular torticollis (see Fig 5). Authors have described these as “midfacial hemihypoplasia” in which the dependent side of the face is vertically shorter with a lower orbit and higher corner of the mouth. The nose and mouth deviate toward the hypoplastic side, consistently observed ipsilateral to the cervical tilt.

The etiology of the facial hemihypoplasia has not been well established. Some have suggested the asymmetries are induced by the chronic tilting of the head. Others have suggested that these asymmetries are the result of deformational plagiocephaly.

Golden et al reported on their observations of a number of patients being treated for deformational plagiocephaly. Although the majority of these patients did not have a palpable muscle mass or discernible contracted state of the sternocleidomastoid ipsilateral to the side of their head tilt, many were unable to consistently keep the head in midline and had decreased ability to actively rotate or laterally flex their head through normal end ranges of motion. This appeared to be secondary to weakness of the sternocleidomastoid on the opposite side rather than tightness on the ipsilateral side. Although only 12% of their study subjects were found to have true CMT, an additional 64% were found to have this sternocleidomastoid imbalance. This lead the authors to conclude “...any degree of neck dysfunction should be considered a potential precursor to the development of positional plagiocephaly.”

Thus, it is also reasonable to speculate that our patient, in adopting an abnormal head and neck posture to aid her binocular vision during waking hours, developed a degree of muscle imbalance in her neck, which may have in turn led to the positional preferences that induced her deformational plagiocephaly (see Fig 2). This is consistent with the hypothesis of Williams et al that “long standing torticollis of ocular origin may eventually produce secondary changes in the neck muscles.”

In 2003, the American Academy of Pediatrics issued a clinical report on the prevention and management of positional skull deformities in infants. In it, they advocated a certain amount of prone positioning, or “tummy time,” while the infant is awake and being observed to help prevent the development of flat spots on the occiput. Furthermore, they observed that, when begun at birth, most deformational plagiocephaly can be prevented by nightly alternating the supine head position from the right to left occiput and periodically changing the orientation of the infant to the environment, for example, crib orientation relative to the door. Although these recommendations were directed to pediatricians and other primary care clinicians, they may be particularly relevant to those treating infants with ocular torticollis.

The exact etiology of the facial asymmetries associated with SOP is not understood, although it has been hypothesized that gravitational forces or sleeping positions may play a role. In two separate series, Paysee et al and Wilson et al reported a lack of these facial asymmetries in patients with acquired supraorbital palsy, whereas its presence was observed in 76% and 77%, respectively, of those patients with congenital SOP. These findings are consistent with those of Goodman et al, who likewise observed significant facial asymmetries only in congenital cases of SOP.

Greenberg et al reported facial hemihypoplasia with facial compression ipsilateral to the head tilt in 41 of 43 patients with a wide variety of types of ocular torticollis, leading them to conclude that the gravitational effects of the head tilt itself may be responsible for the differential remodeling of the head and face, which culminates in the observed asymmetries.
Goodman et al recognized the tendency of CMT to induce deformational facial asymmetries characterized by a flattened, vertically shortened face on the side of the head tilt. Furthermore, they suggested that positional molding during sleep may be the cause of the facial asymmetry associated with the head tilts observed in congenital SOP.33

In our subject, we observed occipital flatness and mild forehead bossing ipsilateral to the head tilt consistent with the anticipated positional deformations. However, the facial hypoplasia was also ipsilateral to the head tilt, suggesting that the subject’s facial asymmetry resulted not because of deformational forces, but despite them.

Therefore, although it appears that the presence of ocular torticollis may predispose an infant toward positional preferences consistent with the development of deformational plagiocephaly, it is unlikely that these deformational forces are responsible for the characteristic facial asymmetry observed in this patient with SOP and resultant ocular torticollis.

**CONCLUSION**

Evidence suggests that even minor muscle imbalances in the neck musculature of infants may predispose them toward preferential positioning patterns and ultimately the development of deformational plagiocephaly. Although the torticollis in SOP disappears when the patient is supine, the posturing of the neck when the child is in an upright position may be sufficient to encourage the development of preferential supine positioning patterns. Patients diagnosed with ocular torticollis may be at risk for the development of deformational plagiocephalies.

Characteristic facial asymmetries have been identified with the presence of CMT, deformational plagiocephaly, and congenital SOP. Although the asymmetries identified with the first two are consistently quite similar, those of congenital SOP are distinctly different. It has been hypothesized that the facial hemihypoplasia observed in congenital SOP is the result of deformational forces. The current clinical study is unique within the literature because of the presence of both deformational plagiocephaly and congenital SOP. In this unique patient, the characteristic facial hemihypoplasia associated with SOP appears to have developed not as a result of deformational forces, but rather despite them, leading to formation of a distinct “gravitational plagiocephaly.”

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Clinical Counterpoint

Ivan Long, CP(E), presents a contrasting perspective on some of the points stated in the article, “The Importance of Soft-Tissue Stabilization in Transfemoral Amputation,” by Frank A. Gottschalk, MD, that appeared in the March 2010 issue of The Academy TODAY.

Among his other contributions, Long is noted as the originator of the socket design concept now known as “ischial containment.” Long’s concept stresses the need for proper alignment of the ischial containment socket by following “Long’s Line,” a straight line starting at the center of the hip joint, passing down through the distal femur, through the center of the heel of the prosthetic foot. Long has used his Long’s Line to align AK prostheses in more than 400 cases in his facility in Colorado. In 1991, Long was the first prosthetist to receive the Distinguished Practitioner Award from the American Academy of Orthotists and Prosthetists (the Academy). In 2005, he was honored with the Hanger Prosthetics & Orthotics Lifetime Achievement Award.

Does Foot Position Influence Femur Position?

Ivan Long, CP(E)

This paper hopes to clear up some questions about abduction of the femur in above-knee prostheses, a very common fault in AK prostheses built in the United States for the last 60 years. The following pictures are from the March 2010, Volume 6, No 2 issue of The Academy TODAY.1

The picture does not show the feet, but Long’s Line on the amputated side is definitely not the same angle as the line on the sound side. It would be impossible for the amputee to bring the femur inward to match the sound side because the prosthetic foot would strike the sound foot. Unfortunately for prosthetists and their AK patients, literature has been published stating that socket shape and alignment have no influence on positioning the femur in normal adduction.2

However, I would like to point out that there are several muscles standing ready to adduct the femur if alignment does not interfere. The textbook called The Extremities lists the following: (1) pectineus, (2) adductor longus, (3) adductor brevis, (4) adductor magnus, (5) quadratus femoris, and (6) obturator externus.3 Amputation level might affect the insertion point of the adductor magnus.

If the prosthetic foot were properly placed, the amputee would be able to achieve normal adduction of the femur before shifting his weight to the amputated side. In my almost 60 years of working with amputees, I have met only one who could not adduct his femur, an elderly man with a very short AK residual limb. He lost his leg as a child after a buggy wheel accident.

The shifting of weight signals the gluteus medius to activate. Place your fingertips just below your belt line on the sides of your hips to feel your gluteus medius muscle activity as you walk normally.

In the sound limb, the intact femur does not move, the gluteus medius stabilizes the spine, and the shoulders remain in place.

The amputated femur must have solid, full-time, comfortable support on its lateral side to simulate the intact femur of the non-amputee. With solid support, the muscles work normally. The amputee can walk with his feet close together and

Figures 1 and 2: The red line is an illustration of Long’s Line. The name came from the physical therapists at Fitzsimons Army Hospital. It is a straight line, but not a plumb line, from the head of the femur to the center of the foot. It must intersect the distal portion of a full-length femur. On short femurs, use your imagination to extend to full length.

Figures 3, 4, 5, 6: Pictured at right are two different amputees showing how a socket with support for the amputated femur positions the femur and holds that position while weight is applied. Both patients had a definite immediate improvement in gait and spinal comfort. More improvement was noted a month later.

All of the x-rays were made at Fitzsimons Army Hospital, Aurora, Colorado.
Clinical Counterpoint

his spine straight. Without support, the gluteus medius pulls the amputated femur outward into abduction, and no signal will be sent to the gluteus medius. The amputee must compensate by moving his upper body out over his prosthetic foot. That foot will be moved outward to a wider base for balance, resulting in a very poor gait.

The following quote is from my article in Orthotics and Prosthetics, December 1975. 4 “Virtually every article written in modern times on above-knee socket construction stresses the importance of support of the femur by the lateral wall of the socket. X-ray studies carried out at Fitzsimons Army Hospital since March 1974 show that very few above-knee prostheses built in the United States today achieve proper adduction of the femoral stump.

“I have been amazed by the number of prostheses that are aligned so that the amputee is prevented from moving the femur into normal or equal adduction, because the prosthetic foot touches the sound foot while the femur is still in abduction. In every case, I found that by simply realigning the knee and foot with respect to the socket, the amputee could bring the femur into a normal position.”

Editor’s note: “Clinical Counterpoint” was developed so that clinicians can present alternate view points on clinical articles that appear in The Academy TODAY. The content does not necessarily reflect the viewpoint of The American Academy of Orthotists and Prosthetists.

References

3. Quiring DP. The Extremities. Cleveland, OH: Cleveland Clinic Foundation; 1945.

Letter from the Annual Meeting Clinical Content Chair

To Academy Members, Annual Meeting Participants:

The 2010 Academy Annual Meeting Clinical Content Committee thanks the speakers, poster presenters, and organizers for their efforts in making the Annual Meeting in Chicago a great success.

We want all concerned to be aware of significant education-programming changes that began with the 2010 Annual Meeting and will continue.

The Clinical Content Committee, with Board approval, has changed the Thranhardt Lectures submission process. Previously, Thranhardt Lecture submissions were self-nominated. However, for the 2010 Annual Meeting, all submitted abstracts were considered for the Thranhardt Lectures and/or Free Papers, unless the submitter opted out of Thranhardt Lecture consideration. This shift dramatically increased the potential abstracts for the Thranhardt Lectures, allowing the “best” of the papers to be considered.

In this process, submissions are blinded (all author identifying information is removed) and distributed to the Clinical Content Committee members for review. Each reviewer scores all of his or her abstracts, identifying potential Thranhardt submissions. The submissions deemed as potential Thranharts are then blinded and distributed to the entire committee for a more in-depth review. After that review is complete, the committee reviews the scores, comments, and recommendations and determines the final Thranhardt Lecture selections. Successful submitters are notified, and all submitters receive communication on the status and committee feedback regarding their submissions.

To standardize the format and criteria for all submissions, all abstracts must be submitted online at www.oandp.org/meeting2011/

Paralleling the trend toward evidence-based practice and medicine, the Academy continues to improve its educational programming’s scientific foundation. We look forward to your submissions and to seeing you all at the 2011 Annual Meeting March 16–19 in Orlando.

Sincerely,
JoAnne Kanas, DPT, CPO
Chair, Clinical Content Committee
The Academy Grant—More for Our Money

On October 1, 2008, the Academy received its fifth one-year, $1 million grant from the U.S. Department of Education. The grant has funded projects ranging from our O&P career-awareness and outreach efforts to our work with the National Commission on Orthotic and Prosthetic Education (NCOPE). Our work with NCOPE has allowed us to develop training materials for existing and potential residency sites and to create educational pathways for advanced O&P degrees, leading to more trained scientists conducting research and fulfilling academic requirements to practice in the O&P profession. We have developed guidelines for and conducted State of the Science Conferences (SSC), developed continuing-education courses based on the findings of those conferences, and promoted the adoption of standards into clinical practice.

Because of the efficiency of our principal investigators and the in-kind efforts of many in the profession, we have managed our grant well and have requested and received from the Department of Education a “no-cost extension” to our grant. This gives us the ability to extend our programs, within the same budget, through September 30, 2010. Because of this additional time, we are able to undertake several more projects that will benefit the profession. Some of these projects are detailed below.

Outreach and Awareness Campaign

During the no-cost extension period, we conducted a high school awareness program at the Academy’s 2010 Annual Meeting and Scientific Symposium. We invited Chicago-area high school students to the meeting to learn about the O&P profession. We offered current O&P students the opportunity to attend the Annual Meeting at a reduced registration rate if they volunteered to assist with this event. During the session, we showed our new career-awareness DVD and had stations set up around the room where the high school students had the opportunity to try on various orthotic devices, put together an artificial limb, see how a prosthetic hand works, and “walk” on artificial legs, among other things. Following this, each high school student was paired with an O&P student for a tour of the Exhibit Hall for a look at all of the manufacturers’ displays. This event was a highlight of the week for many of the O&P students and, after attending, some of the high school students responded that they are seriously considering a career in O&P.

In addition, we will attend the Health Occupations Students of America (HOSA) and the American School Counselors Association (ASCA) Annual Meetings this year to exhibit and present sessions on O&P career awareness. At these meetings, we will have the opportunity to expose thousands of career counselors, teachers, students, and others involved in health-science education to the profession of O&P as a possible career. We will also provide copies of our career kit to countless practitioners who are helping us spread the word about O&P as a career by conducting in-service training sessions and speaking at career fairs and other educational events.

Research for the Profession

By September 30, 2010, we will conduct and publish the Proceedings of a State of the Science Conference on “The Effects of AFOs on Balance.” In addition, we will produce and publish an Evidence Report and two Evidence Notes, the topics of which are still in development. This dissemination of clinical consensus and scientific evidence for improved practice will go a long way toward impacting the way O&P practitioners care for their patients on a daily basis.

Entry-Level Education

Continuing our work with NCOPE during the no-cost extension period will allow progress to continue on the development of a series of online courses for residency sites. The first module, to prepare sites to implement a residency program, was completed during the grant year and is available on the Academy’s Online Learning Center at www.oandp.org/olc/ncope/. Work on the second module will continue during the no-cost extension period and will focus on assisting residency sites in the development of a learning environment for an effective residency program and experience.

A Focus on the Profession

All of our work on grant-related activities is done with the goal of advancing the O&P profession and the O&P practitioner. As we move toward the end of this grant cycle, we will continue to look for new and creative projects that will have a lasting impact for years to come.

For more information about these programs or any of the Academy’s other grant-related activities, contact Kimber Nation, Academy grant administrator and council coordinator at knation@oandp.org or call 202.380.3663.
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