

# Cerebral Palsy: is there a Trigeminal Factor

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## **Hypothesis: Cranio-mandibular malalignment is a major contributor to the etiology of cerebral palsy.**

Jaw malalignment<sup>i</sup> is widely present in the human genetic pool. It is often passed on to subsequent generations, sometimes in a more extreme form. Analysis of primitive skulls has shown that the mandible has increasingly retruded for centuries, causing increased jaw malalignment.<sup>ii</sup> Multiple research studies have shown that with jaw malalignment, a broad spectrum of medical disorders occurs.<sup>iii</sup> Recent clinical evidence leads me to believe that the collective symptoms of CP may be within that spectrum.

Spasticity is the primary characteristic of CP. There are a number of neurological pathways that are activated in the presence of bite disturbances that contribute to spasticity. In particular, when teeth height is lowered on one side it causes the opposite side of the body to tighten up. This has been demonstrated extensively in research done in Japan.<sup>iv</sup> This phenomenon has been used in the treatment of scoliosis in this country for over 40 years by a group of dentists in the Midwest.<sup>v</sup>

The primary mechanism by which this occurs is known: trigeminal proprioceptors are known to modulate the golgi tendon apparatus systemically and contra laterally, hence causing increased muscle tension. Secondly, clinical evidence, medical literature, and neuroanatomy support the fact that bite disturbance causes elevated *substance P* levels, which are known to increase spinal spasticity.<sup>vi</sup>

Trigeminal disturbance could also account for other characteristics of CP including: vestibular dysfunction (equilibrium), seizures<sup>vii</sup>, speech difficulty<sup>viii</sup>, and eye tracking difficulties.<sup>ix</sup>

Thirty years of experience in the area of jaw malalignment therapy suggests that the dentofacial orthopedic treatment required to reverse CP symptomology needs to be at a level of precision that is currently unknown in dentistry. The lack of cooperation found when working in the mouth with many CP patients presents another major challenge. My current clinical experience suggests that it would be difficult but not impossible.

## References

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<sup>i</sup> Jaw malalignment occurs when the muscles suspending the mandible want the jaw to be in a position other than where the teeth support the jaw. The defect may be in any or all dimensions

<sup>ii</sup> Br Dent J. 2006 Jan 14;200(1):33-7

**A cephalometric comparison of skulls from the fourteenth, sixteenth and twentieth centuries.**

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**OBJECTIVES:** To evaluate changes in the size and shape of the skull and jaws in British populations between the thirteenth and twentieth centuries.

**RESULTS:** Horizontal measurements in the base of the anterior cranial fossa and in the maxillary complex were greater in the modern group than in the medieval skulls. Cranial vault measurements were significantly higher ( $P=0.000$ ) in the twentieth century skulls, especially in the anterior cranial fossa.

**CONCLUSION:** Results suggest that our medieval ancestors had more prominent faces and smaller cranial vaults than modern man.

<sup>iii</sup> Cranio. 1998 Jul;16(3):185-93

**Health care utilization by patients with temporomandibular joint disorders.**

**Shimshak DG, DeFuria MC.** Management Science & Information Department, University of Massachusetts, Boston 02125, USA.

The claims data base of a large New England managed care organization was used to compare the health care utilization patterns of patients with TMJ disorders to non-TMJ subjects. Inpatient, outpatient and psychiatric claims data were examined over a wide range of diagnostic categories. Age and sex adjusted results showed that, overall, patients with TMJ disorders were greater utilizers of health care services and had higher associated costs than non-TMJ subjects. For some of the major diagnostic categories, such as nervous, respiratory, circulatory, and digestive, the inpatient and outpatient claims differences in utilization and costs were as large as 3 to 1. For only one diagnostic category, pregnancy and childbirth, were utilization and costs greater for non-TMJ subjects than TMJ patients. The psychiatric claims for TMJ patients exhibited differences that were at least twice as large as those for the non-TMJ subjects. PMID: 9852811

J Orofac Pain. 2001 Spring;15(2):158-69

**Health care utilization and cost among health maintenance organization members with temporomandibular disorders.****White BA, Williams LA, Leben JR.** Kaiser Permanente Center for Health Research, 3800 N. Interstate Avenue, Portland, Oregon

**AIMS:** Little has been reported on the use of health care services and consequent costs among persons with temporomandibular disorders (TMD). This project compared the use and cost of medical and dental care services for TMD patients and matched comparison subjects.

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Utilization and cost estimates were determined and compared for selected medical and dental services.

**RESULTS:** For both groups, the mean age was about 40.5 years, and approximately 80% were female. The TMD subjects used significantly more services than did comparison subjects and had mean costs that were 1.6 times higher for all services. Outpatient visits accounted for about 40% of the difference in mean costs. About 10% of TMD subjects and comparison subjects accounted for about 40% and 47% of the costs in each group, respectively.

**CONCLUSION:** Patients with TMD used more of all types of services and had higher costs. A small proportion of the subjects accounted for a large proportion of the costs. Gender was an important factor in utilization and cost. Utilization and cost differences were consistent over a wide range of service categories and could not be explained by TMD alone.

<sup>iv</sup> *Azuma Y, K Maehara, T Tokunaga, M Hashimoto, K Ieoka & H Sakagami: Systemic effects of the occlusal destruction in guinea pigs. In Vivo 1999, 13, 519-524.*

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*Ueda T: Effects of occlusal destruction in rats on posture J. Gifu Dent. Soc. 1991, 18, 192-202.*

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<sup>v</sup> Burns, D: POSTURE AND YOUR BITE . TMDiary Volume 16 Number 2, Fall/Winter 2003

<sup>vi</sup> J Spinal Cord Med. 1995 Jan;18(1):42-6.

**Action of 5-hydroxytryptamine, substance P, thyrotropin releasing hormone and clonidine on spinal neuron excitability.**

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We investigated the influence of four substances on the excitability of lumbar motoneurons. These substances, three of which coexist in the same bulbospinal descending pathways that end, for the most part, around motoneurons (MNS), are: 5-hydroxytryptamine (5-HT), substance P (SP) and thyrotropin-releasing hormone (TRH). We also studied the effects of clonidine, an alpha 2 noradrenergic (NA) agonist. This study was carried out in rats spinalized at T5 and treated three weeks earlier with 5-7 dihydroxytryptamine (5-7 DHT). Under these conditions, the following responses were observed: 5-HTP (5-HT precursor) intraperitoneally (I.P.), 5-HT intrathecally (I.T.), TRH (I.P. or I.T.) and substance P (I.T.) all elicited strong excitation of MNS as measured by integrated EMG of the hindlimb muscles; substance P reduced by almost half the response to 5-HTP given one hour and 24 hours later; TRH given acutely did not modify the response to 5-HTP, but given chronically for 21 days markedly increased the response to this substance. Clonidine by itself decreased the excitability of MNS and antagonized the excitatory effects of 5-HTP and TRH. In two separate pilot trials, cyproheptadine, a 5-HTP antagonist, decreased the manifestations of spasticity in a patient with a partial spinal lesion. It would appear that clonidine may have potential use in the management of spasticity.

PMID: 7543799

<sup>vii</sup> Bite therapy has been reported to be effective for seizures for many decades. I published an article on the subject approximately 20 years ago. Seizures are known to be associated with elevated substance P, which decreases cell

<sup>viii</sup> Jennings D, Speech as a diagnostic criteria for the identification of cranio-mandibular dysfunction

<sup>ix</sup> Eye muscle proprioception is coordinated through a division of the trigeminal nerve

Exp Eye Res. 2000 Apr;70(4):411-8.

**Somatotopic organization of primary afferent perikarya of the guinea-pig extraocular muscles in the trigeminal ganglion: a post-mortem DiI-tracing study.**

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Apart from the somatotopic organization of the trigeminal ganglion (TG) into the ophthalmic, maxillary and mandibular divisions along the mediolateral axis, there exist further somatotopic organizations within these three divisions. According to literature, the cell organization in the TG and the somatotopy in the brainstem develop together, formed by naturally occurring cell death in the TG. Thus, the somatotopy of the primary afferent trigeminal perikarya is of special interest. The aim of this study was to investigate the location of the primary afferent perikarya of the extraocular muscles (EOMs) in the TG of guinea-pig. The primary afferent perikarya were labeled by post-mortem application of the carbocyanine DiI on the oculomotor nerve branches near their entrance into the single EOMs. The DiI-positive perikarya were found musculo-somatically organized in the ipsilateral ophthalmic part of the TG at a wide range along the dorsoventral axis, expressing an overlap of the representation areas. The primary afferent perikarya of the superior rectus and the superior oblique muscles were mainly localized in the dorsal part of the ganglion

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while those of the inferior rectus and the inferior oblique muscle mainly in ventral part. The lateral and the medial rectus were predominantly represented in between. An organization along the mediolateral axis of the TG was not observed. Although guinea-pigs lack classical EOM proprioceptors, the somatotopic representation of the extraocular muscle primary afferent perikarya in the TG found in this study is in line with findings in species with well known encapsulated proprioceptors within the EOMs. PMID: 10865989

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