

# Special Investigation Procedure of Postural Disorder Related to Developmental Mandibular Asymmetry: A Review

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Keyword: Mandibular, trunk, asymmetry, body postural disorder

Abstract: Some previous studies have reported the comprehensive visions about the correlation between developmental of dentofacial problems and postural disorder. This paper aims to describe some evidence bases dentistry in malocclusion patients with mandibular asymmetry which should be considered as a multidisciplinary approach, especially related to the postural disorder. We used different electronic databases like Pubmed Health and Google Scholar with specific keywords such as mandibular asymmetry, trunk asymmetry, body postural asymmetry. In this study, there was an indication that most studies reported that temporomandibular disorder (TMD) involved and contribute to this phenomenon asymmetry. We assumed the necessity for considering these as a special investigation procedure in developing asymmetries examination. However, the limitation of epidemiological studies in these developmental asymmetries should consider the translational approach in determining the etiology and the risk factors in the future.

## 1 INTRODUCTION

The timing of the pubertal growth spurt is paramount in planning orthodontic treatment since the general growth and development influence orthodontic treatment prognosis. In human skeletal growth, the skeletal basis of the postural is normally developed at the same age as well as mandibular growth and development (Mellion, 2013, Sharma, 2014). By understanding the relationship between the stomatognathic system and body posture, we can improve the muscular-skeletal disorders that are associated with temporomandibular joint disorders, occlusal changes, and tooth loss (Cuccia, 2009). The symmetry assessment becomes a key determinant for assessing attractiveness and expressions in psychology and anthropology nowadays, including facial and body posture.

The point at which normal asymmetry becomes abnormal cannot be easily defined and is often determined by the clinicians sense of balance and the patient's sense of imbalance. There was generalized asymmetry of the face and body with the left-sided predominance in the evaluation of laterality nose, face, and body as a new finding (Hafezi, 2017). In dentistry, a significant facial

asymmetry may adversely affect the patient's orofacial, nutritional and psychosocial development caused esthetic and functional problems (Bishara, 1994; Srivastava, 2018; Choi, 2015). Comprehensive evaluations of asymmetries might be one of great helps for the physicians, physiotherapists, and dentist for every precise diagnosis and thus selecting the best possible functional rehabilitation techniques. Because of less design and diagnostic techniques in solving the mystery of development asymmetry that including dental, craniofacial and body postural; the gnathology world required to increase more interdisciplinary approach. Further researches to establish a direct link between poor posture and TMD is required in order to obtain good function, improve aesthetics, and stability (Pacella, 2017).

Previous studies have reported some comprehensive visions between developmental of dentofacial problems and postural disorder. However, the amount of dentists that was able to diagnose the occlusal disease and of those who diagnose many people resort to aggressive treatment modalities is still limited. Patients with facial asymmetry usually exhibit compensatory head posturing due to which the head is tilted slightly to

the right or left to compensate for the effect of asymmetry. Therefore, the clinician should deliberately orient the patient's head to correct any compensatory head posture prior to making a proper objective and quantitative examination. The patient is also advised to eliminate other compensatory mechanisms such as mannerisms and hairstyle that might mask the asymmetric deformity, thus misleading the treatment plan (Srivastava, 2018). There are many compensation mechanisms occurring within the neuromuscular system regulating body balance (Manfredini, 2012). Also, there was a well-preserved postural balance in the presence of temporomandibular joint internal derangement that related to mandibular asymmetry should be considered in potential influence the whole body posture that leads to TMD, and vice versa. There was no feature of any peculiar changes in body posture (Rocha, 2016).

In spite of there were no certain conclusion in some associations between the cephalometric variables and the EMG activity of the head, neck, and trunk muscles were observed, there was possible on the mechanism concerning these results and require longitudinal studies in the future (Tecco, 2010). This review study about special investigation procedure of postural disorder related to developmental mandibular asymmetry due to the multifactorial of asymmetry and homeostasis of human being, especially in facial and posture.

### **1.1 Methodology**

All published articles were obtained in electronic databases like PubMed, Scopus, Web of Science, and Google Scholar. The search keywords included mandibular asymmetry, trunk asymmetry, body postural asymmetry

### **1.2 Mandibular Symmetry**

In orthodontics, we can anticipate difficulties with treatment if we are well informed about the principles of symmetry and thoroughly familiar with craniofacial growth (Camille, 2013). The previous study that was conducted in 1460 patients at the University of North Carolina and reported that 34% of individuals were found with a prevalence of facial asymmetry, with a deviation of the chin being the most remarkable feature of asymmetry. Deviation of the chin was present in 74% of asymmetrical patients, with a frequency of lateral guidance of the upper and midface equal to 5% and 36%, respectively (Severt and Proffit, 1998).

An understanding of the etiology of mandibular asymmetry and a thorough methodical diagnostic approach is essential for the appropriate management of patients presenting with dentofacial asymmetry (Brionne, 2013). The management of patients presenting with a mandibular asymmetry that focusing particularly on the treatment of developmental asymmetries is a prime diagnostic in orthodontic treatment nowadays (Chia, 2008). Mandibular asymmetry has an embryological origin. The morphogenesis of the facial bones is the culmination of complicated mechanisms that take place between the 4th and 10th week in the life of the embryo. A malfunction of the mechanisms of cellular migration, of apoptosis or of cellular differentiation can compromise these processes and lead to malformations (Lin, 2013). In the vertical plane, facial asymmetry is apparently most prevalent among patients with a vertical growth pattern (Severt and Proffit, 1998). Unilateral vertical maxillary excess and mandibular asymmetry are usually associated with an occlusal cant. This explains why most asymmetries cannot be treated with single-jaw surgery (Cheong and Lo, 2011). The development of asymmetry is a complex and multifactorial phenomenon. Facial asymmetry is scarcely addressed in dental literature although being highly prevalent in the overall population. The limitation of epidemiological studies, as well as histological and genetic research aiming at determining the etiology and the risk factors, should be advised in the future (Thiessen, 2015).

### **1.3 Imbalance Body Postural**

Body posture is defined as the result of the relationship between near segments of the body as well as the interconnections between all segments composing the human body. From a theoretical viewpoint, the ideal posture is the condition in which all structures combine their work to maintain static and dynamic balance with maximum efficiency and minimal overload and energy expense. On the contrary, poor posture is seen as a faulty relationship between the different body segments, requesting an increased demand for adaptation to the support structures and a decreased equilibrium efficiency (Gonzalez, 1996). The postural disorders that were identical with trunk imbalance or asymmetry, are variations in transversal, vertical, and sagittal (Sidlauskienė, 2015).

#### 1.4 Mandibular Asymmetry and Imbalance Posture

There was plausible evidence for an increased prevalence of unilateral Angle Class II malocclusions associated with scoliosis and an increased risk of malocclusions, such as lateral crossbite and midline deviation in children affected by scoliosis. Then, the improvement of some documentation about associations between a reduced range of lateral movements and scoliosis seems convincing because also mentioned about the association between plagiocephaly and scoliosis (Huggare, 1998; Saccuci, 2011). Previous studies reported the trunk asymmetry and postural disorder as the phenotype of scoliosis. There was a more frequent and severe dentofacial deviation in the spinal disorder with Scheuermann's disease than scoliosis children. Caution of early detection was required from an orthodontic point of view (Segatto, 2008). In the correlation analysis, the ramus length difference and anterior nasal spine-mentum angle had a possible correlation with the coracoid height difference, clavicular angle, radiographic shoulder height, and clavicle-rib intersection difference ( $P < .05$ ) (Hong, 2011). The degree of mandibular deviation has a high correlation with the degree of scoliosis and trunk imbalance in a case-control study of the adult population. There was a linear trend in the degree of scoliosis and shoulder imbalance correlated with the degree of mandibular deviation. The direction of mandibular deviation was the same as that of the lateral bending of thoracolumbar vertebrae whilst was opposite to the direction of lateral bending of cervical vertebrae (Zhou, 2013).

The symmetry of craniofacial structures remains unaffected by moderate trunk asymmetry in young adults (Zepa, 2003). While correlations between jaw position and body posture for the cervical spine can exist, there was a postural compensatory mechanism that leads to minimize the effects of jaw position and body posture for cervical spine in general population (Arienti, 2017). Visual perception control is most important in orienting the head in the frontal plane in the Swedish young adults, with moderate trunk asymmetry and the head position maintained by cervical spine adaption. However, there was a significant difference between patients with a skeletal horizontal-vertical facial axis and patients with a basal distal-mesial position for the facial depth in pelvic torsion (Lippold, 2007).

By including postural considerations in orthodontic diagnosis at the final analysis, it will lead to a total corporal analysis in mandibular

asymmetry in addressing the clinical approach integrating treatment of corporal posture into orthodontic care (Amat, 2008). There was a relationship between mandibular position and body postural. Conversely, changing body posture affected the mandibular position in asymptomatic subject between 21 to 53-year-old (Sakaguchi, 2007). In the evaluation of postural body stability and malocclusions in different skeletal patterns of orthodontic patients showed that decreased stability and increased sway in based on malocclusion severity. Then a significant increasing of sway area and sway velocity postural parameters in body postural stability between subjects with myogenous TMD compare to healthy controls (Arumugam, 2016; Nota, 2017).

#### 1.5 Malocclusion and Imbalance Posture

It was concluded that malocclusion is associated with the posture of the changes, since the balance, only two studies presented this outcome and was in a considered positive for the worsening of static equilibrium, but with no clinical application, and another positive for improves dynamic balance (Stancker, 2015). The more extended treatment of the malocclusions closely correlated to postural disorders in children with spinal disorders (Segatto, 2008). However, there were claims of an association between body posture and dental occlusion in growing subjects should be discarded on the basis of epidemiological observations among 12-year-old children in Italy (Perillo, 2008).

The existence of clinically relevant correlations between malocclusion traits and body posture in population age range 10.6-16.3-year-old among local sports subjects based on posturography as a diagnostic aid was not suggested (Perrineti, 2010). However, it differs with another study that reported about sway area seems to be the most sensitive parameter for evaluating the effect of occlusion on body posture in healthy subjects (Baldini, 2013). There is not enough scientific evidence to support an overview about preventing postural imbalances or alteration of spine curvatures by performing occlusal and/or orthodontic treatment although some associations between occlusal factors and postural alterations have been reported (Michelotti, 2019).

## 2 DISCUSSION

The individual's postural position can suffer biomechanical alterations due to stomatognathic alterations. This condition causes clinically visible changes in dysfunctional individuals and affecting the performance of the involved structures including temporomandibular joint, cervical, spinal, and leg that lead to body posture (Strini, 2008; Salkar, 2014). This issue is important since all gnathological's athletes should be analyzed individually and carefully with clinical and instrumental analyses in order to consider the possible real effectiveness of an occlusal splint to improve the postural structure and sports performance (Baldini, 2012). The present study reviewed the literature studies showing the relationship between wrong posture and TMD. The close relationship has also been confirmed between TMD and changes in body posture. Patients with TMD are expected to present postural shifts, such as the anterior displacement of the head, increased cervical lordosis, and lack of shoulder leveling (Armantea, 2004). However, the variance of body postural disorder that leads to the poor methodological quality of analysis can explain for the weak evidence observed (Chaves, 2014). There was only 21 % among practitioners in India that were aware of the interdisciplinary approach in treating patients with severe malocclusion, TMD, musculoskeletal, myofascial pain and body postural (Joshi, 2015).

## 3 CONCLUSIONS

There was an indication that most studies reported that temporomandibular disorder (TMD) involved and contribute to this phenomenon asymmetry. We assumed the necessity for considering these as a special investigation procedure in developing asymmetries examination. However, the limitation of epidemiological studies in these developmental asymmetries should consider the translational approach in determining the etiology and the risk factors in the future.

## ACKNOWLEDGMENTS

We want to thank for the Ministry of Research and education with the Grant no. 11/E1/KP.PTNBH/2019 and also for Derek's assistance.

## REFERENCES

- Amantea DV., Novaes AP., Campolongo GD., Barros TP. 2004. The importance of the postural evaluation in a patient with temporomandibular joint dysfunction. *Acta Ortop Brass*; 12 (3): 155-59. <http://dx.doi.org/10.1590/S1413-78522004000300004>
- Amat P. 2008. Occlusion and posture: facts and beliefs. *J Dentofacial Anom Orthod*; 11:186-211. doi: 10.1051/odfen/2008030
- Arienti C., Villafañe JH., Donzelli S., Zaina F., Buraschi R., Negrini S., 2017. Trunk and craniofacial asymmetry are not associated in the general population: a cross-sectional study of 1029 adolescents. *Eur J Med Res*; 22, 36.
- Arumugam P, Padmanabhan S, Chitharanjan AB.2016. The relationship between postural body stability and severity of the malocclusion. *APOS Trends Orthod*;6:205-10. doi: 10.4103/2321□1407.186436
- Baldini, A. *et al.* (2012) 'Gnathological postural treatment in a professional basketball player: a case report and an overview of the role of dental occlusion on performance.', *Annali di stomatology*.
- Bishara, SE., Burkey, PS., Kharouf JG., 1994. Dental and Facial Asymmetries: A Review. *Angle Orthod*; 64(2);89-98.
- Brienne C., Cadre B., Laroche Y., Lhotellier J., Maze M., Raffre A., Sorel O., 2013. The diagnosis of mandibular asymmetries. *J Dentofacial Anom Orthod*;16:302. DOI: 10.1051/odfen/2013202
- Cheong, Y., and Lo, L. (2011). Facial Asymmetry: Etiology, evaluation, and management. *Chang Gung Med J* 34: 341-51.
- Chia SY., Naina FB., Gill DS., 2008. The etiology, Diagnosis, and Management of Mandibular Asymmetry. *Orthodontic Update* : 44- 42
- Choi KY., 2015. Analysis Of Facial Asymmetry. *Arch Craniofac Surg*; Vol.16 No.1, 1-10 [Http://Dx.Doi.Org/10.7181/Acfs.2015.16.1.1](http://Dx.Doi.Org/10.7181/Acfs.2015.16.1.1)
- Chaves TC., Turci AM., Pinheiro CF., Sousa LM., Grossi DB. 2014. Static body postural misalignment in the individual with temporomandibular disorder: a systematic review. *Braz J Phys Ther*; 18 (6): 481-501. <http://dx.doi.org/10.1590/bjpt-rbf.2014.0061>
- Cuccia A., Caradonna C., 2009. The Relationship Between The Stomatognathic System and Body Posture. *Clinics*; 64(1):61-6.
- Gonzalez HE, Manns A. Forward head posture: its structural and functional influence on the stomatognathic system, a conceptual study. *Cranio*. 1996;14:71-80.
- Hafezi F., Javdani A., Naghibzadeh B., Ashtiani AK., 2017. Laterality and Left sidedness in the nose, face, and body: a new finding. *PRS Global Open*: 1-6.
- Hong, J.Y., Suh, S.W., Modi, H.N., Yang, J.H., Hwang, Y.C., Lee, D.Y., et al. (2011). Correlation between facial asymmetry, shoulder imbalance, and adolescent idiopathic scoliosis. *Orthopedics* 34(6): 187.

- Huggare J. 1998. Postural disorder and dentofacial morphology. *Acta Odontologica Scandinavica*; 56 (6): 385-86. <http://dx.doi.org/10.1080/000163598428374>
- Joshi NM, Kulkarni AD, Srichand R., 2015. Evaluation of the knowledge regarding the correlation between body posture, pain, and occlusion amongst the practicing dentist of Navi Mumbai- Questionnaire-based study; *IJOOR*; 3:21-24.
- Lin, H., Zhu P., Lin Y., Wan S., Shu X., Xue Y., and Zheng Y., 2013. 2013. Mandibular asymmetry: a three-dimensional quantification of bilateral condyles. *Head Face Med* 9: 1-7
- Lippold C., Moiseenko T., Drerup B, Schilgen M., Vegh A and Danesh G., 2012. Spine Deviations and Orthodontics Treatment Of Asymmetry Malocclusion In Children. *BMC Musculoskeletal Disorders*; 13:151. Available at <http://www.biomedcentral.com/1471-26/13/151>.
- Manfredini D., Castorflorio T., Perinetti G., & Nardini L.G., 2012. Dental occlusion, body posture, and temporomandibular disorders: where we are now and where we are heading for. *J of Oral Rehabilitation*. 1-9. doi: 10.1111/j.1365-2842.2012.02291.x
- Mellion JZ., Behrens RG., Johnston Jr LE., 2013. The pattern of facial skeletal growth and its relationship to various common indexes of maturation. *Am J Orthod Dentofacial Orthop*; 143:845-54. doi: 10.1016/j.ajodo.2013.01.019
- Michelotti A., Buonocone G., Manzo P., Pelegrino G., Farella M. 2010. Dental occlusion and posture: an overview. *SIDO*; 12: 53-8. doi:10.1016/j.pio.2010.09.010
- Nota A., Tecco S., Ehsani S., Podulo J., Baldini A. 2017. Postural stability in subjects with temporomandibular disorder and healthy controls: A comparative assessment. *J Electromyography and Kinesiology*; 37: 21-24. <http://dx.doi.org/10.1016/j.jelekin.2007.08.006>
- Pacella E., Dari M., Giovannoni D., Caterini L., Mezio M., 2017. The relationship between temporomandibular disorders and posture: a systematic review. *WebmedCentral*; 2046-1690 : 1-5. [http://www.webmedcentral.com/article\\_view/5339](http://www.webmedcentral.com/article_view/5339)
- Perillo L., Signoriello G., Ferro F., et al. 2014. Dental occlusion and body posture in growing subjects. A population-based study in 12 years old Italian adolescent. *I Dent SA*; 10 (6): 46-52.
- Perrinetti G., Contardo L., Biavati AS., Perdoni L., Castaldo A. 2010. Malocclusion and body posture in young subjects: a multiple regression study. *Clinics*: 689-95. doi: 10.1590/S1807-59322010000700007
- Rocha T., Castro MA., GuardaNardini L., Manfredini D., 2016. Subjects with temporomandibular joint disc displacement do not feature any peculiar changes in body posture; *J of Oral Rehabilitation*. <http://dx.doi.org/10.1111/joor.12470>
- Saccucci M., Tettamanti L., Mummolo S., Polimeni A., Festa F., Tecco S., 2011. Scoliosis and Dental Occlusion: A Review Of The Literature. *Scoliosis*: 6-15
- Sakaguchi K., Mehta NR., Abdallah EF., Forgione AG., et al. 2007. Examination of the relationship between mandibular position and body posture. *The J Craniomandibular Practice*; 25(4):237-49. <http://dx.doi.org/10.1179/crn.2007.037>
- Salkar RG., Radke UM., Deshmukh SP., Radke PM., 2015. Relationship Between Temporomandibular Joint Disorders and Body Posture. *Int J Dent Health Sci*; 2(6)1523-1530
- Segatto E., Lippold C., Véghe A., 2008. Craniofacial features of children with spinal deformities. *BMC Musculoskeletal Disorders*, 9:169 doi:10.1186/1471-2474-9-169
- Severt TR, Proffit WR. The prevalence of facial asymmetry in the dentofacial deformities population at the University of North Carolina. *Int J Adult Orthodon Orthognath Surg*. 1997;12(3):171-176.
- Sharma, P., Arora, A. and Valiathan, A. (2014) 'Age changes of jaws and soft tissue profile', *Scientific World Journal*. doi: 10.1155/2014/301501.
- Sislauskienė M., Smailienė D., Lopatiene K., Cekanaukas E., Pribuisiene Ruta., Sidlauskas M., 2015. Relationship between Malocclusion, Body Posture and Nasopharyngeal Pathology in Pre-Orthodontic Children. *Med Sci Monit*; 21: 1765-1773. doi: 10.12659/MSM.893395
- Srivastava D, Singhb H., Mishraa S., Sharmab P., Kapoorb P., Chandraa L., 2018. Facial Asymmetry Revisited: Part I- Diagnosis and Treatment Planning. *Journal of Oral Biology and Craniofacial Research* 8: 7-14
- Stancker TG., Oliveire Silva AC., Neto HP., Rodrigues CD., 2015. Malocclusion Influence on Balance and Posture: a systematic review. *MTP & Rehab Journal*; 13:015.
- Strini PISA., Machado NA., Gorreei MC., Ferreira A., Sousa G., Neto AJF. 2019. Postural evaluation of patients with temporomandibular disorders under use of occlusal splints. *J Appl Oral Sci*; 17(5):539-43. doi: 10.1590/S1678-77572009000500033
- Thiesen G., Gribel BF., Freitas MPM., 2015. Facial asymmetry: a current review. *Dental Press J Orthod*. Nov-Dec;20(6):110-25 <http://dx.doi.org/10.1590/2177-6709.20.6.110-125.sar>
- Zepa I., Hurmerinta K., Kovero O., Nissinen M., Könönen M., Huggare J., 2003. Trunk asymmetry and facial symmetry in young adults. *Acta Odontol Scand*; 61(3):149-53.
- Zhou S, Yan J, Da H, Yang Y, Wang N, et al. 2013. A Correlational Study of Scoliosis and Trunk Balance in Adult Patients with Mandibular Deviation. *PloS ONE* 8(3):e59929. doi:10.1371/journal.pone.0059929