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Temporomandibular disorders in young people with an intellectual disability: prevalence of signs and symptoms

ABSTRACT

Aim *To assess the prevalence of signs and symptoms related to TMJ disorders in a group of young people with intelectual disability (ID) and a matched group of healthy adolescents.*

Materials and methods *A group of 105 young Special Olympics (SO) athletes (ID group) aged from 14 to 25 years and a control group were examined for the presence or absence of signs and symptoms of TMD through interview and clinical examination.*

Results *A total of 64 young people with ID (61%) had at least one sign of TMD compared to 41 (39%) of the individuals screened that was free of any TMD symptoms. A significantly higher prevalence of TMJ sounds (palpation and stethoscope), TMJ tenderness, maximum vertical opening, headaches were observed among SO athletes compared to the healthy control group ($p<0.05$). A significant difference was recorded only for the Temporalis tenderness between the girls and boys ($p<0.05$).*

Conclusion *TMJ disorders are noticeable problem for intellectually disabled patients and a possible cause of pain that should be examined more in detail. We suggest that oral screening in people with a mental disability should be modified by including basic TMJ examination parameters in order to allow better understanding of the pathological aspects so as to address effective preventive and therapeutic measures.*

Keywords *Disability; Special Needs; TMD.*

Introduction

The Special Olympics Special Smiles (SOSS) programme is a segment of the Special Olympics Healthy Athletes (SOHA) initiative, providing non-invasive oral health screening and referrals, data collection, oral health education, and preventive dental supplies for athletes with a mental disability throughout the world. The mission of the SOSS programme is to increase access to dental care for SOSS athletes as well as all children and adults with Intellectual Disability (ID), and to increase the number of dental professionals who will serve them in their practices. It is also a means of increasing awareness of the athletes as well as their parents and/or caregivers of the importance of oral health [Dellavia et al., 2009; Oredugba and Perlman, 2010; Fernandez et al., 2012; Special Olympics, 2014]. The process of improving oral health in a disabled population begins with the collection of epidemiological data, which helps to understand the needs of the community, to identify high-risk groups, and to plan treatment and prevention strategies [Bharathi et al., 2010].

The term Temporomandibular Dysfunction (TMD) has been described as a cluster of disorders characterised by: pain in the preauricular area, the TMJ, or the muscles of mastication; limitation or deviations in mandibular range of motion; and noises in the TMJ during mandibular function [Farsi, 2003]. The diagnosis and treatment of temporomandibular disorders (TMD) in children and young adults have received increased attention in the past 20 years. The reported prevalence of TMD in children ranges between 7% and 68% [Emodi-Perlman et al., 2012].

Numerous studies have documented the oral health of SO athletes [Dellavia et al., 2009; Oredugba and Perlman, 2010; Fernandez et al., 2012; Special Olympics 2014], but informative data on TMD of special needs athletes are very scarce in literature and are missing on most clinical standard oral screening records and especially on the standard questionnaire SOHA records. Therefore, this study was carried out to assess the prevalence of signs and symptoms related to TMJ disorders among a group of intellectually disabled, SO athletes, aged 14-25 years and a similar age group of healthy youngsters attending government schools in Turkey.

Materials and methods

Study design and population

The cross-sectional study was conducted on a sample of 105 young S0 athletes; 70 (66.7%) males and 35 (33.3%) females with permanent dentition aged from 14 to 25 years (mean age=17.20±2.63) and 104 healthy adolescents (60 males, 58%, and 44 females, 42%), mean age 16.31±1.42, as the control group, to assess the prevalence of signs and symptoms related to TMJ disorders and to test applicability of the TMD examination methods.

Ethical consideration

The study was authorised by the Human research Ethics Commission of Marmara University in accordance with the recommendations of the Helsinki Declaration. All the athletes who were intellectually disabled in the study were attending to SO Healthy Athletes athleticism event in ADANA-Turkey in 2011. Athletes volunteered of their own accord and consent was obtained from a parent /trainer or caregiver.

Calibration of the examiner

One dentist was calibrated in terms of the clinical TMD signs to be registered before the start of oral examinations. In regard to the functional analysis, she was trained to locate the specific muscle and joint palpation sites and to apply a moderate pressure at these sites. The examining dentist practiced the clinical procedure on 20 children who were not part of the study group. Each of the initial 20 children was examined twice, with an interval between examinations, with the results of the first examination not being available to the investigator while performing the second one. The intra-rater reliability was above 85%.

Examination

A self-report questionnaire was completed by all subjects or by their trainers. The screenings were carried out concurrently with the games, and the Centers for Disease Control and Prevention (CDC) in Atlanta, was used for the oral screenings for SO athletes [White et al., 1998].

A control group of healthy adolescents was selected randomly from a local public school in central Istanbul. These subjects also received a full explanation of the nature of the study and those who volunteered underwent an identical clinical examination. Healthy subjects who were undergoing any type of orthodontic treatment or were suffering from systemic health disease were excluded from the study.

The investigation comprised history data collection, in the form of an interview of the athlete-his/her trainers about preauricular pain, facial pain, headaches and jaw tenderness on function, and a clinical examination , that comprised a registration of mandibular mobility and an evaluation of the temporomandibular joints with regard to tenderness of the joint capsule and clicking or grating sounds. The athletes-trainers were requested to answer the questionnaire concerning history of pain or ache in the jaw, temples, face, preauricular area, or inside the ear at rest or during function. The questionnaire also evaluated the following qualitative (yes or no) aspects of pain during mastication or mouth opening, speaking, yawning or eating, difficulty during mouth opening, headaches once a week or more, joint click and jaw tiredness [Farsi, 2003; Emodi-Perlman et al., 2012; Vanderas and Papagiannoulis, 2002; Sari and Somnez, 2002; Toscano and Defabianis, 2002; Weiler et al., 2010]. Anamnestic information about TMJ and clinical examination of children in the control group was retrieved in the same way.

Since head posture can be an important factor in TMD diagnosis, the examinations were performed in an upright position [Farsi, 2003]. Functional examination of TMJ was performed measuring maximal jaw movements, recording joint sounds, evaluating pain on movement of the jaw as well as tenderness to palpation of either TMJ or masticatory muscles (m. temporalis, m. masseter, m. sternocleidomastoideus, m. trapezius, opening/closing deviation) [Sari and Somnez, 2002; Toscano and Defabianis, 2002; Weiler et al., 2010; Köhler et al., 2009]. The muscles that were palpated were the anterior and posterior portions of the temporal muscle and the superficial and deep portions of the masseter and sternocleidomastoid muscles. All the sites were palpated bilaterally [Farsi, 2003; Vanderas and Papagiannoulis, 2002; Bonjardim et al., 2005; Toscano and Defabianis, 2002].

Examination of TMD included the following aspects.

1) Clicking sounds or crepitations from the temporomandibular joints were detected using a stethoscope over the TMJ area and by having the patient open and close the mouth [Köhler et al. Helkimo, 1974; Akeel and al-Jasser, 1999; Sonnesen et al., 1998].
2) Mobility was measured (in millimeters) upon opening, lateral excursions and protrusion, taking due account of vertical and horizontal overjet. The child was asked to open as wide as possible and the inter-incisal distance measurement (maximum vertical opening) was recorded. A distance of less than 40 mm was regarded as restricted opening [Castello et al., 2005; Helkimo, 1974; Okeson and O'Donell, 1989; Feteih, 2006]. The opening deviation was defined as the displacement of mandible at least 2 mm to the right or left of an imaginary vertical line when the mandible had reached half of its vertical opening [Feteih, 2006].
3) Manual palpation of TMJ and associated muscles was performed to detect tenderness using the index, middle and the ring fingers. The masseter, temporalis and sternocleidomastoid muscles were palpated

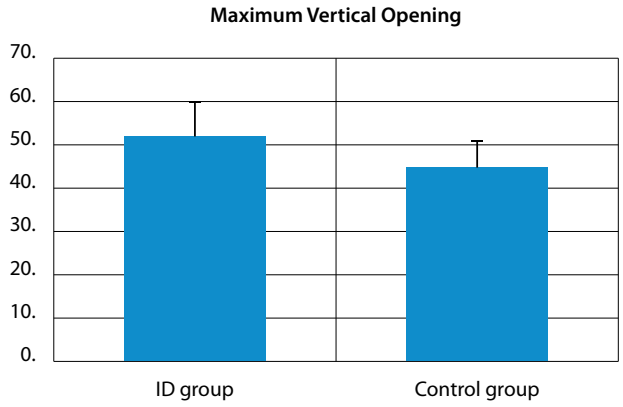

FIG. 1 Maximum vertical opening of the mouth in mm.

bilaterally and the TMJ tenderness was also assessed during mandibular movement. Pain was registered as 'absent' or 'present'. [Castello et al., 2005; Weiler et al., 2010; Feteih, 2006].

Statistical analysis

SPSS (Statistical Package for Social Sciences) for Windows 15.0 was used for statistical analysis of the study data. Chi-square test was used to compare the mean, frequency, and standard deviation values of qualitative data. For evaluation of quantitative data, Student-t test was used. Results were assessed in the 95% confidence interval using a significance level of $p<0.05$.

Results

A total of 64 SO athletes (61%) and 50 (48%) of the healthy individuals screened had at least one sign of TMD. Figure 1 shows the prevalence of the different signs of TMD in both groups.

No statistically significant difference was observed between SO athletes and the control group in relation to the prevalence of malocclusion, condyle deflection, m. masseter tenderness and m. temporalis tenderness. However the prevalence of TMJ sounds via stethoscope, TMJ crepitus as determined by palpation, 2 mm deviation and headache in SO athletes, was significantly higher than in the control group. The prevalence of pain in the TMJ area was significantly lower among in SO athletes ($p<0.01$).

TMJ sounds heard by stethoscope were the most frequent sign in the total sample of 105 athletes (38.1%), while pain in TMJ area was the least frequent sign as it was registered in only 7 athletes (6,7%).

There was a significant difference in temporalis muscle tenderness between genders. Tenderness was significantly higher in females than males ($p<0.05$).

No restrictions in mouth opening were seen. The average maximal opening capacity was 52.00±7.67 mm. However, during opening, a deflection of the mandible beyond 2 mm was observed in 32% of athletes. Maximum vertical opening was statistically higher in SO group than the control ($p<0.01$) (Fig. 1).

Headache was the most frequently reported subjective symptom followed by TMJ sounds, but reports of frequent headaches were rare.

Discussion

The prevalence of temporomandibular joint dysfunction (TMD) in the adolescent and child population has been reported previously and varies considerably depending on the sample selection, the criteria used to define disc displacement, and the type of study conducted [Köhler et al., 2009; Keeling et al., 1994; Gazit et al., 1984; Egermark-Eriksson, 1981]. To our knowledge, this study addresses a problem not previously investigated, namely the prevalence of signs and symptoms related to TMJ disorders in a group of SO athletes with intellectual disability. TMD is a collective term used to describe a number of related disorders involving TMJ function, masticatory muscles and occlusion with common symptoms such as TMJ pain, restricted movement, muscle tenderness on palpation and intermittent joint sounds [Farsi, 2003; Toscano et al., 2009; Sarı et al., 2002; Egermark-Eriksson, 1981]. In the AAPD guidelines it was reported that all comprehensive dental examinations should include a screening evaluation of the TMJ and surrounding area. Diagnosis of TMD is based upon a combination of case history data, clinical examination, and/or craniocervical and TMJ imaging. The findings are classified as symptoms and signs [Clinical affairs, 2010]. However screening and imaging of TMJ can be very difficult in special needs patients as their cooperation during the examination can be limited.

A number of studies on TMD and oral parafunction among children have included both a questionnaire for subjective symptoms and a clinical examination [Farsi, 2003; Emodi-Perlman, 2012; Bonjardim et al., 2005; Weiler et al., 2010; Köhler et al., 2009]. Although this combination seems crucial for this special study group, in order to obtain objective data about TMJ disorders, this study was conducted with a questionnaire in combination with a clinical examination at oral screening during a Special Olympics tournament. Although these athletes varied considerably in the type and degree of their disability, all of them had the skills required for daily living to enable them as individuals to work, play and live in the community at large.

In this study, 61% of the SO athletes and 48% of the control group presented at least one sign and/or symptom of TMD. Despite this, no significant difference was found between the SO athletes and the controls regarding the presence of at least one sign or symptom

of TMD (p >0.05), even though the percentage of athletes who scored P (61%) was higher than the control (48%). A larger sample might demonstrate a significant difference. Compared with earlier research, our prevalence results for disabled athletes are much higher than those found by Egermark-Eriksson et al. [1981], with a prevalence of 46.7% in children aged 7 to 15 years old, and also those observed by Akeel and Al-Jasser [1999], with a prevalence of 41% in children aged 8, 14, and 18 years, and by Farsi [2003], with a prevalence of 20.7% in children aged 3-15 years. It should be noted that these findings refer to a population of individuals with ID attending a SO tournament in Turkey who are not necessarily representative of the general population of individuals with ID. Furthermore, it is an aim of SO screening to offer an activity in the medical venue to reduce the anxiety often experienced by these young people with special needs when they are faced with a visit to a doctor or dentist, not to create an organized survey. This may mean that differences found in the comparison of our data obtained from the SO event, to other studies, may arise because of differences in data collection and sample selection methods.

Manual Palpation (MP) is one of the most frequently employed methods for evaluating Temporomandibular Disorders (TMD) [Reid at al., 1994] and is recommended by the Research Diagnostic Criteria for TMD (RDC/TMD) despite its low reliability [Dworkin and LeResche, 1992]. MP was performed by applying firm constant pressure with the index finger as recommended by Dworkin and LeResche [1992]. It should be noted that this method has some limitations such as: different examination techniques, location and size of sites palpated and the amount of pressure applied [Murphy et al., 1992]. Since all groups were clinically examined by one trained observer in our study, it is likely that comparison of the clinical signs within the groups was more consistent than if multiple observers were used. Despite this, no statistically significant difference was observed between the SO athletes and the control group regarding m. masseter or m. temporalis tenderness.

In the present study, the most prevalent symptoms found in SO athletes and the control group were: malocclusion (39% and 31%), condyle deflection (36% and 26%), TMJ sounds in stethoscope (38% and 18%) and headaches (33% and 17%). Among these, the prevalence of TMJ sounds in stethoscope and headache in SO athletes was significantly higher than in the control group. However, the prevalence of pain in the TMJ area was significantly lower in SO athletes (p<0.01).

When we analyse the results in figure 1, we can observe that malocclusion is present in both disabled and healthy groups, although not statistically significant between the groups. Orthodontic treatment of children with intellectual disabilities has long been neglected. This may be because it can be difficult to communicate with and obtain cooperation from these patients; also, the variation of the degree of intellectual disability is extremely great. Apart from a small number of patients with specific syndromes, for example Crouzon's syndrome, there are no absolute contraindications (even within the Down's syndrome group) for treatment [Muppa et al., 2013]. It is therefore fundamental that the care offered by health professionals is comprehensive, integrated and multidisciplinary. It is especially important to encourage parents/guardians to seek dental care for younger children, when preventive procedures and education are still possible. An appropriate approach to addressing these determinant factors may lead to a reduction in the prevalence of malocclusion.

The prevalence of TMJ sounds has been reported to be increasing from primary to permanent dentition, due to the longer duration of muscle tension in older age groups, causing intracapsular changes and consequently TMJ sounds [Farsi, 2003; Magnusson et al., 2005; Barbosa et al., 2008]. The developmental state of the dentition may affect the frequency of occurrence of TMJ sounds in the mixed and permanent dentition [Thilander et al., 2002; Barbosa et al., 2008]. Also, the methods used to diagnose TMJ sounds can influence results. For example, the use of the stethoscope instead of listening with unaided ear may result in an overestimation of TMJ symptoms [Barbosa et al., 2008]. Previous studies reported clicking in children at a rate ranging from 6.8 to 65% [Farsi, 2003; Kritsineli and Shim, 1992; Feteih, 2006]. This wide range of results can probably be attributed to differences in the examination methods. This study showed a very high incidence of TMJ sounds in permanent dentition, probably because of our strict clinical examination and the use of stethoscope.

In accordance with reports by Farsi [2003] and Köhler et al. [2009], but in contrast to the results of several other studies [Bonjardim et al., 2005; Feteih, 2006], the present survey did not detect any gender difference in TMD prevalence. This may be due to our relatively small sample size and an offset female/male ratio. The female-to-male ratio is important because studies have shown that gender differences are small in childhood, but starting from late adolescence, females exhibit more temporomandibular symptoms and more clinical signs than males. It is postulated that this may be due to the influence of biologic variables (e.g., hormonal characteristics) [Bonjardim et al., 2005; Magnusson et al., 2005; Barbosa et al., 2008]. Muscular disorders had a greater prevalence among girls, but this finding must be interpreted carefully due to the low specificity of intra-oral muscle palpation. The discomfort or pain observed in response to palpation may be caused by anatomical structures instead of the muscle itself [Barbosa et al., 2008]. A gender comparison in our study has shown a significant difference in Temporalis muscle symptoms with tenderness being significantly

higher in females than in males ($p<0.05$).

It is well known that questions relating to pain and headaches may be difficult to apply to special needs athletes at different stages of cognitive development. Other factors contributing to experimental bias are that children can be so co-operative that false positive responses are obtained, or the parents had not been aware of the child's headaches [Macfarlane et al., 2001]. Unfortunately, intellectually disabled patients are often unable to accurately localise and/or describe their pain. The experience of pain is inherently private and subjective. It is thus not directly accessible to others and requires considerable judgment and skill on the part of observers in the use of available cues if inferences about it are to be accurate. This means it is more difficult to use the symptom of pain to understand and diagnose the cause of a disease [Macfarlane et al., 2001; Van Dijk et al., 2009; Versloot and Craig, 2009]. Various pain assessment instruments for cognitively impaired children have comparable content, but vary in number of items. However, none of these instruments have been tested or implemented in the dental setting [van Dijk et al., 2009]. We evaluated the qualitative (yes or no) aspects of pain and recorded pain as present or absent. In our study, headaches in the mornings were reported in higher frequency. It is possible that reported headaches could have other causes than overload of muscles related to the temporomandibular joint.

Reduced range or deviation of movement has been regarded as an important sign or symptom in the diagnosis and treatment of TMD, despite opening deviation of movement appearing rarely in epidemiological studies [Farsi, 2003; Barbosa et al., 2008]. The presence of disease in one or both TMJs can lead to altered; mainly decreased mandibular movement ranges [Macfarlane at al., 2001]. Mouth opening of less than 40 mm was considered as restricted opening by Okeson and O'Donnell [1989]. When Egermark-Eriksson et al. [1981], used 40 mm as a cut-point for the normal limit of mouth opening, they found that 10% of children at 7 years old had restricted opening. Castello et al. [2005] reported a mandibular deviation rate of 18.18% and Thilander et al. [2002] as 9%. In the present study involving only subjects with intellectual disability, the cut-point for the normal limit of mouth opening for young athletes was 40 mm. However, no restrictions in mouth opening were seen. We found that the average mouth opening was 52.00±7.67 mm (range 40 mm to 80 mm, n=105). During opening, a deflection of the mandible beyond 2 mm was observed in 32% of athletes in our study. Maximum vertical opening was statistically higher in SO group than the control ($p<0.01$).

Due to the lack of evidence-based literature on TMJ disorders in adolescents with mental disability, it is difficult to make comparisons between disabled and non-disabled individuals.

Conclusion

It is plausible that intellectual disability may restrict the dental-treatment options provided or offered by the dental care service. The results of the current study suggest that TMJ disorders are a noticeable and underestimated problem for young people with intellectually disability and a possible cause of pain that should be examined in more detail. We suggest that, especially for subjects with mental disability, the oral screening protocol be modified to include basic TMJ examination parameters in order to allow better understanding of the pathological aspects of TMD and so begin to address more effective preventive and therapeutic measures for this patient group. Finally, it is suggested that the globally used SOHA screening protocol be modified on the basis of our experience and the results presented in this survey.

Conflict of interest

The authors have no conflict of interest to declare

Why this paper is important to paediatric dentists:

- Unique data on TMJ problems in young patients with an intelectual disability
- Indication of the importance of a standard TMJ screening
- Temporalis muscle symptoms with tenderness being significantly higher in females than in males also in this group of young people.

References

› Akeel R, Al-Jasser NJ Oral Rehabil. Temporomandibular disorders in saudi females seeking orthodontic treatment 1999 26(9):757-762.
› Barbosa Tde S, Miyakoda LS, Pocztaruk Rde L, Rocha CP, Gavião MB. Temporomandibular disorders and bruxism in childhood and adolescence: review of the literature. Int J Pediatr Otorhinolaryngol 2008 72(3):299-314.
› Bharathi M. Purohit;Shashidhar Acharya, Meghashyam Bhat. Oral health status and treatment needs of children attending special schools in South India: a comparative study. Spec Care Dentist 2010 30(6): 235-241.
› Bonjardim LR, Gavia˜o MB, Pereira LJ, Castello PM, Garcia RC. Signs and symptoms of temporomandibular disorders in adolescents. Bras Oral Res 2005 19 (2): 93-98.
› Castello P., Gavião M, Pereira L, Bonjardım L. Relationship between oral parafunctional/nutritive sucking habits and temporomandibular joint dysfunction in primary dentition. Int J Paediatr Dent 2005 15: 29–36.
› Clinical Affairs Committee – Temporomandibular Joint Problems in Children Subcommittee, Guideline on Acquired Temporomandibular Disorders in Infants, Children, and Adolescents. Clinical Guidelines 2010 33: 6; 11-12.
› Dellavia C, Allievi C, Pallavera A, Rosati R, Sforza C. Oral health conditions in Italian Special Olympics athletes. Spec Care Dentist 2009 29(2): 69-74.
› Dworkin SF, LeResche L. Research diagnostic criteria for temporomandibular disorders: review, criteria, examinations and specifications, critique. J Craniomandibular Disorders 1992 6:301-55.
› Egermark-Eriksson I, Carlsson GE, Ingervall B. Prevalence of mandibular dysfunction and orofacial parafunction in 7- 11- and 15-year-old Swedish children. Eur J Orthod 1981 3:163–172.
› Emodi-Perlman A, Eli I, Friedman-Rubin P, Goldsmith C, Reiter S. Bruxism, oral

parafunctions, anamnestic and clinical findings of temporomandibular disorders in children. J Oral Rehabil 2012 39: 126–135.
› Farsi NM. Symptoms and signs of temporomandibular disorders and oral parafunctions among Saudi children. J Oral Rehabil 2003 30(12):1200-1208.
› Fernandez JB, Lim LJ, Dougherty N et al. Oral health findings in athletes with intellectual disabilities at the NYC Special Olympics. Spec Care Dentist 2012 32(5): 205-209.
› Feteih RM. Signs and symptoms of temporomandibular disorders and oral parafunctions in urban Saudi arabian adolescents: a research report. Head Face Med 2006 16; 1-7.
› Gazit E, Lieberman M, Eini R, Hirsch N, Serfaty V. Prevalence of mandibular dysfunction in 10–18-year-old Israeli schoolchildren, J Oral Rehabil 1984 11:307–317.
› Helkimo M. Studies on function and dysfunction of the masticatory system. II. Index for anamnestic and clinical dysfunction and occlusal state. Sven Tandlak Tidskr 1974 67(2):101-121.
› Keeling SD, McGorray S, Wheeler T, King GJ. Risk factors associated with temporomandibular joint sounds in children 6 to 12 years of age. Am J Orthod Dentofacial Orthop 1994 105(3):279-87.
› Köhler AA, Helkimo AN, Magnusson T, Hugosan A. Prevalence of symptoms and signs indicative of temporomandibular disorders in children and adolescents. A cross-sectional epidemiological investigation covering two decades. Eur Arch Paediatr Dent 2009 10 Suppl 1:16-25.
› Kritsineli M, Shim YS. Malocclusion, body posture, and temporomandibular disorder in children with primary and mixed dentition. J Clin Pediatr Dent 1992 16(2):86-93.
› Macfarlane TV, Gray RJM, Kincey J, Worthington HV. Factors associated with the temporomandibular disorder, pain dysfunction syndrome (PDS): Manchester case-control study. Oral Diseases 2001 7: 321-330.
› Magnusson T, Egermark I, Carlsson GE,.A prospective investigation over two decades on signs and symptoms of temporomandibular disorders and associated variables. A final summary, Acta Odontol Scand 2005 63: 99-109.
› Muppa R, Bhupathiraju P, Duddu MK, Dandempally A, Karre DL. Prevalence and determinant factors of malocclusion in population with special needs in South India. J Indian Soc Pedod Prev Dent. 2013 31(2):87-90.
› Murphy GJ, Mckinney MW, Gross WG. Temporomandibular-related pressure thresholds: a model for establishing baselines. Cranio 1992 10:118-23
› Okeson JP, O'Donnell JP. Standards for temporomandibular evaluation in the pediatric patient. Pediatr Dent 1989 11:329– 330.
› Oredugba FA, Perlman SP. Oral health condition and treatment needs of Special Olympics athletes in Nigeria. Spec Care Dentist 2010 30(5): 211-217.
› Reid KI, Gracely RH, Dubner RA. The influence of time, facial side, and location on pain-pressure thresholds in chronic myogenous temporomandibular disorder. J Orofac Pain 1994 8:258-65.
› Sarı S, Sonmez H. Investigation of the relationship between oral parafunctions and temporomandibular joint dysfunction in Turkish children with mixed and permanent dentition. J Oral Rehabil 2002 29(1):108-112.
› Sonnesen L, Bakke M, Solow B. Malocclusion traits and symptoms and signs of temporomandibular disorders in children with severe malocclusion. Eur J Orthod 1998 20(5):543-59.
› Special Olympics: http://www.specialolympics.org/healthy_athletes.aspx [Accessed 23 december 2014]
› Thilander B, Rubio G, Pena L, Mayorga C. Prevalence of temporomandibular dysfunction and its association with malocclusion in children and adolescents: An epidemiologic study related to specified stages of dental development. Angle Orthod 2002 72(2):146-154.
› Toscano P, Defabianis P. Clinical evaluation of temporomandibular disorders in children and adolescents: a review of the literature. Eur J Paediatr Dent 2009 10(4):188-192.
› van Dijk M, Valkenburg A, Boerlage AA, Tibboel D, Veerkamp JS. Children with intellectual disabilities and pain perception: a review and suggestions for future assessment protocols. Eur Arch Paediatr Dent 2009 10(2):57-60.
› Vanderas AP, Papagiannoulis L. Multifactorial analysis of the aetiology of cranio-mandibular dysfunction in children. Int J Paediatr Dent 2002 12 (5):336-346.
› Versloot J, Craig KD. The communication of pain in paediatric dentistry. Eur Arch Paediatr Dent 2009 10(2):61-66.
› Weiler RM, Vitalle MS, Mori M, Kulik MA, Ide L, Pardini SR et al. Prevalence of signs and symptoms of temporomandibular dysfunction in male adolescent athletes and non-athletes. Int J Pediatr Otorhinolaryngol 2010 74(8):896-900.
› White JA, Beltrán ED, Perlman SP. Training manual for standardized oral health screening. Atlanta, Georgia: Division of Oral Health. National Center for Chronic Disease Prevention and Health Promotion at the Centers for Disease Control and Prevention (CDC), 1998.