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Clinical evaluation of temporomandibular disorders in children and adolescents: a review of the literature

ABSTRACT

Aim The abbreviation TMD (temporomandibular disorders) has been used to signify the variety of symptoms, signs and combinations that have often been assigned to the TMJ (temporomandibular joint) and its related structures (muscles, bone and facial structures). The prevalence of temporomandibular disorders in children and adolescents varies widely in literature. The most common signs and symptoms of TMD are: temporomandibular joint sounds, impaired movement of the mandible, limitation in mouth opening, preauricular pain, facial pain, headaches and jaw tenderness on function. Many studies have shortcomings in their method of assessing or measuring TMD: the problem is probably due to the fact that temporomandibular disorders have multiple aetiological factors. The aim of this article is a review of the literature about the diagnostic procedures used to assess signs and symptoms of temporomandibular disorders in children and adolescents.

Materials and methods Literature was searched using Medline, Embase, and Cochrane Library from 1992 to February 2008. Only articles written in English were included in the study. The key words and mesh used were: temporomandibular disorders, mandibular dysfunction, children, adolescents. The inclusion criteria were: symptoms and signs of TMD, questionnaire, clinical protocol examination. Clinical studies as well as cross-sectional studies, longitudinal and epidemiological researches were considered. The articles reviewed were grouped according to the diagnostic procedure used.

Results Out of the 37 articles selected, the Helkimo Clinical Dysfunction Index was used in 6 studies (16.22%), the CMI Index in 1 (2.70%), the RCD/TMD in 9 (24.33%) and a clinical protocol examination in 21 (56.75%) articles. **Conclusion** The review of the literature shows that clinical examination protocols without reproducible items and a measurable and reproducible classification into diagnostic subgroups was the type of investigation used in most of the cases. This ended in a multitude of different results depending on the criteria used and the method of data collection. Such methodological problems should be acknowledged in studies relating to TMD in order to obtain a reliable diagnostic procedure.

Key words: Temporomandibular disorders; Mandibular dysfunction; Children; Adolescents.

Introduction

The abbreviation TMD (temporomandibular disorders) has been used to signify the variety of symptoms, signs and combinations that have often been assigned to the TMJ (temporomandibular joint) and its related structures (muscles, bone and facial structures). Temporomandibular disorders are often difficult to define and measure, therefore, numerous problems exist when clinical studies are undertaken. Many studies have shortcomings in their method of assessing or measuring TMD: the problem is probably due to the fact that temporomandibular disorders have multiple etiological factors. Signs and symptoms of TMD have been investigated, although their prevalence varies according to the criteria used and the method of data collection, and the reported prevalence of temporomandibular disorders varies widely in literature [List et al., 1999; Stockstill et al., 1998; Paesani et al., 1999]. In these studies, various signs and symptoms have been used to define temporomandibular conditions, but it is not clear whether they can be considered normal variation, preclinical features or manifestation of an already developed pathologic condition. Diagnosis should include a screening history to be performed on all patients [Guidelines on acquired temporomandibular disorders in infants, children and adolescents, 2002-2003]. Longitudinal studies tend to show that the prevalence of signs and symptoms increases with age and that the prevalence of signs is greater than the prevalence of symptoms. Egermark and Eriksson [1981] noted that the prevalence of symptoms increased from 30% to 60% between 7 and 15 years. Symptoms and signs may appear and disappear within a single individual [Heikinheimo et al., 1990], and symptoms tend to be more prevalent in females than males [Agerberg and Carlsson, 1972]. They also seem to be affected by ethnicity, social class and psychological status. Where signs rather than symptoms are investigated sex differences tend to vanish, although this is not supported by all studies [Solberg et al., 1979]. Regarding children and adolescents, many authors focused on the existence of possible connections between TMD and a variety of clinical conditions (type of occlusion, orthodontic treatment, oral parafunctions, headache, anxiety, etc) in order to predict which patient would be more likely to develop temporomandibular disorders. For all these reasons, the development of a universally accepted diagnostic system of clinical evaluation of these patients was, and still is, a definite necessity, but the problem is that many different definitions of TMJ dysfunction have come into existence, and consequently the diagnosis of TMJ dysfunction depends on the definition used.

Helkimo was a pioneer in the development of indices to measure the severity of TMJ pain and dysfunction. In 1974 [Helkimo, 1974] he developed his clinical Dysfunction Index (DI) which included three different parts: the Anamnestic Index, the Clinical Dysfunction Index and the Occlusal State Index. The Anamnestic index is based on the evaluation of subjective symptoms of dysfunction reported by the patient and has three different levels of increasing severity. The Clinical Dysfunction Index is an index of functional evaluation of the masticatory system

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which takes into consideration the following items: range of mandibular movements and TMJ function impairment, pain during mandibular movement, TMJ pain on palpation. Each area of interest is scored so that patients can be divided into four groups depending on the increasing severity of the pathology. The Occlusal State Index is obtained by considering the number of teeth, number of teeth in occlusion, occlusal interference between centric relation and centric occlusion. Patients can then be categorised into three different groups depending on the score obtained.

In 1986 Friction and Schiffman [1986] developed the Craniomandibular Index (CMI) to provide a standardised evaluation method of temporomandibular disorders in epidemiological and clinical studies. The CMI is a simple clinical index defined by objective criteria and is divided into two subscales according to joint or muscle problems: the Dysfunction Index (DI), related to limits in range of motions, presence of deviation in movements, evidence of pain and TMJ noise on function; the Palpation Index (PI), related to tenderness at distinct anatomical sites during intraoral palpation of jaw muscles and extraoral palpation of jaw and neck muscles. Furthermore, it has detailed, precise descriptions of how examination and scoring is undertaken.

The Research Diagnostic Criteria for Temporomandibular Disorders (RDC/TMD) were published in 1992 to provide a standardised definition of diagnostic subgroups of patients with orofacial pain and TMD and undoubtedly improved the shortcomings of the prior system [LeResche et al., 1992]. The RDC/TMD Axis I was developed in an attempt to identify a set of clinical criteria to categorise patients in epidemiological and clinical studies. It recognizes three main groups of patients: those affected by masticatory muscle disorder (myofascial pain with dysfunction), by degenerative joint disease (arthrosis/arthritis) and those showing signs of TMJ internal derangement with relative subgroups.

The aim of this article is to review the literature about the diagnostic procedures used to investigate temporomandibular disorders in children and adolescents.

Materials and methods

To identify all studies that examined the diagnostic assessment of TMD in children and adolescents a computerised literature search was performed from 1992 to February 2008. Temporomandibular disorders in children (age 3-12) and adolescents (age 13-18) was searched in the subject heading and it was crossed with combinations of the following terms: "clinical protocol examination", "questionnaire", "anamnestic interview", "mandibular dysfunction", "signs and symptoms of temporomandibular disorders". Only articles that met the following criteria were included:

- articles in English language;
- TMD evaluation performed with a questionnaire and/or an interview and a clinical protocol examination;
- studies had to be case series, cross-sectional, longitudinal or epidemiological surveys;
- to avoid multiple publications bias only one representative article for each study reported with

different titles and in different journals was chosen.

The articles reviewed were grouped according to the diagnostic procedures used, as described in tables 1, 2: for each article examined tables 1, 2 report: authors and country, sample size, age range, control matched group, type of assessment.

Results

Out of the 37 articles selected (100%), the clinical protocol examination related to Helkimo Index, or Helkimo Index modified, was found in 6 studies (16.22%), to CMI Index in 1 (2.70%), to the RCD/TMD in 9 (24.33%) while in 21 (56.75%) a clinical protocol examination without reproducible items and a measurable and reproducible classification into diagnostic subgroups was used (Tables 1, 2).

Discussion

The review of the literature showed how different diagnostic procedures lead to a great variability of results, depending on the criteria and the methods of data collection used. Another often overlooked reason is that, especially for longitudinal and epidemiological surveys, examinations methods designed for adults have been applied for children, without consideration of age.

Results may be further complicated by the assessment of the reliability of clinical examiners in measuring TMD, particularly in children, as in these patients symptoms and signs evaluation may be very critical. Dworking et al. [1991] investigated a group of examiners specially trained to use detailed specifications and criteria (i.e. analysis of mouth opening pattern, muscle palpation etc.) before conducting the clinical examination of patients and controls. Despite this careful preparation, they concluded that if excellent reliability was found for vertical range of motion measures and for summary indices, many clinical signs important in the differential diagnosis of subtypes of TMD were not measured with high reliability: pain-response assessment and identification of specific TMJ sounds, for example, seem to be measured only with "modest" or sometimes "marginal" reliability.

The most investigated signs of TMD in the reviewed studies were: mandibular mobility, opening deflection, TMJ function, presence of joint clicking, TMJ pain and muscle tenderness on palpation with heterogeneous results originating from lack of a universal diagnostic system. Many of the studies investigating TMJ problems used the Helkimo clinical Dysfunction Index or a modification of this index, originally designed as an epidemiological tool [Friction and Schiffman, 1986]. Van der Weele and Dibbets [1987] discussed in details the problems connected to the use of this index, which largely corresponds to validity and reproducibility. They stated that the index could be used to measure the prevalence of symptoms but its relevance in measuring latent symptoms was not demonstrated, and concluded that there was not sufficient evidence to support its general applicability. In other words, it was of limited use in clinical outcome studies, due to its low sensitivity in measuring small

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Authors and country	Sample size	Age range	Control matched	Diagnostic procedures
Liljeström MR et al., Finland	192	6-13	Y	Q C.E.
Feteih RM, Saudi Arabia	385	12-16		Q C.E.
Liljeström MR et al., Finland	297	13-14		I C.E.
Castelo P.M. et al., Brazil	99	3-5		Q C.E.
Tuerlings V, Limme M, Belgium	136	6-12		C.E.
Bonjardim L.R. et al., Brazil	99	3-5		Q C.E.
Alamoudi, Saudi Arabia	502	3-7		Q C.E.
Liljeström MR et al., Finland	297	13-14		I C.E.
Farsi et al., Saudi Arabia	116	4-6	Y	Q C.E.
Alamoudi, Saudi Arabia	502	3-7		C.E.
Akeel R. Al-Jasser N, Saudi Arabia	191	8,14,18		C.E.
Widmalm SE et al., USA	540	m.a. 5.1		I C.E.
Stockstill JW et al., USA	422	6-12		C.E.
Deguchi T et al., Japan	160	m.a. 10.1		Q C.E.
Liu JK, Tsai MY, China	508	6-56		C.E.
Widmalm SE et al., USA	525	4-6		I C.E.
Farsi N et al., Saudi Arabia	1976	3-15		Q C.E.
Miyazaki H.et al., Japan	532	6-38		I C.E.
Adair SM, Hecht C, USA	20	4,19,20	Y	Q C.E.
Motegi E et al., Japan	7337	6-18		I C.E.
Hans MG et al.,	51	8-15		Q C.E.

Q: questionnaire I: interview CE: clinical examination Y: yes

TABLE 1 - Evaluation of TMD in children and adolescents

alterations of the masticatory system and to the fact that it did not evaluate joint and muscle problems separately.

Despite these considerations, many authors continue to use the Helkimo clinical Dysfunction Index or a variant of it [Mohlin et al., 1991]. The Craniomandibular Index (CMI) [Friction and Schiffman, 1986; Friction and Schiffman, 1987] addresses the problems of reliability and validity associated with the Helkimo index, but needs careful standardization. It is a lengthy procedure to use (it has six areas of interest to score, divided according to joint or muscle problems, and has detailed, precise descriptions of how examination and scoring have to be performed).

On the other hand for the RCD/TMD [Whalund K et al.,1998] good to excellent reliability was found for measuring range of motion, TMJ sounds and assessing pain location, pain on movements and on palpation of TMJ muscles in children and adolescents.

Even if has been reported in literature that it is not clear whether signs and symptoms may constitute normal variation, preclinical features or manifestations of a disease, some studies indicate that joint sounds and TMJ

symptoms are common in small children and could represent a possible onset of early TMD.

For this reason, further studies are needed to obtain a reliable diagnostic system to evaluate these patients as the present multitude of classifications based upon aetiology, clinical signs and symptoms or anatomy have their intrinsic weakness as the diagnostic criteria and classifications vary.

Conclusion

The review of the literature shows how clinical examination protocols without reproducible items and a measurable and reproducible classification into diagnostic subgroups was the type of investigation used in most of the cases (56.75%).

This yielded to a multitude of different results depending on the criteria used and the method of data collection.

Even if has it been reported in literature that it is not clear whether signs and symptoms may constitute normal

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Authors and country	Sample size	Age range	Control matched	Diagnostic procedures
Conti A et al., Brazil	200	9-20		Q C.E. Helkimo mod.
Sonnesen L et al., Denmark	96	7-13		C.E. Helkimo
Thilander B et al., Sweden	4724	5-17		I Q C.E. Helkimo mod.
Morrant D.G. et al. UK	301	6-54		Q C.E. Helkimo
Egemark I, Ronnerman A. Sweden	50	7-16	Y	Q C.E. Helkimo
Tanne K et al. Japan	305	4-29		Q C.E. Helkimo
Bonjardim L.R. et al Brazil	217	12-18		Q C.E. CMI
LeResche L. et al. USA	1996	11,14		I Q C.E. RDC/TMD
De Coster P.J. et al. Belgium	82	6-61	Y	Q C.E. RDC/TMD
Fischer D.J. et al. Washington	398	11-17	Y	I C.E RDC/TMD
Hirsh C. et al. Germany	3033	10-75		C.E RDC/TMD
Ing-Marie Nilsson et al. Sweden	120	12-19	Y	I C.E RDC/TMD
Hirsh C. et al. Germany	1011	10-18	Y	Q C.E. RDC/TMD
Goddard G. Karibe H. California	192	5-84		Q C.E. RDC/TMD
List T. et al. Sweden	127	12-18	Y	Q C.E. RDC/TMD
List T. et al. Sweden	862	12-18		Q C.E. RDC/TMD

Q: questionnaire I: interview CE: clinical examination Y: yes CMI: craniomandibular index RDC/TMC: Research Diagnostic Criteria for Temporomandibular Disorders

TABLE 2 - Evaluation of TMD in children and adolescents.

variation, preclinical features or manifestations of a disease, findings are important for early diagnosis in order to detect factors that can interfere with proper stomatognathic system growth and development.

At present, the "perfect" study is probably still to be undertaken; in addition, further work investigating diagnosis and method of assessment appears to be necessary.

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