Professional karate-do and mixed martial arts fighters present with a high prevalence of temporomandibular disorders

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Abstract – Background/aim: Facial trauma in sports has been associated with temporomandibular disorders. Because of the intensity and duration of training needed for elite-level competitions, high-performance athletes can have two to five times more traumatic injuries than recreational athletes. This study aimed to investigate the prevalence of temporomandibular disorders in high-performance martial arts fighters and compare it with the prevalence in recreational athletes and non-athletes. Material and Methods: The Research Diagnostic Criteria for Temporomandibular Disorders was used to diagnose and classify professional karate-do practitioners (group I; n = 24), amateur karate-do practitioners (group II; n = 17), high-performance mixed martial arts fighters (group III; n = 13), and non-athletes (n = 28). The groups were compared with the chi-square test and tested for the difference between two proportions using a significance level of 5% (P < 0.05). Results: The prevalence of temporomandibular disorders in groups I (54.2%; P = 0.003) and III (61.5%; P = 0.002) was significantly higher than in group IV (14.3%). The prevalence in group II was similar to that in group IV (P > 0.05). A diagnosis of arthralgia from disk displacement was made more frequently in groups I (45.8%; P = 0.013) and III (38.5%; P = 0.012) than in group IV (7.1%). The chronic pain associated with TMD was low intensity and low disability. Conclusions: While there was a high prevalence of temporomandibular disorders in the professional athletes in our study, the prevalence of the condition in recreational athletes was similar to that in individuals who did not practice martial arts.

Key words: temporomandibular disorders; temporomandibular joint; athletes; martial arts; trauma in athletes

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Accepted 18 September, 2015

By definition, temporomandibular disorders (TMD) cover a wide range of clinical problems involving the masticatory muscles and the temporomandibular joints (TMJ) either individually or together (1). They are clinical conditions with multifactorial etiologies and a range of manifestations (2). The factors associated with TMD can be structural (lax ligaments), psychological (anxiety, emotional stress), and traumatic (macro-trauma) (3), which can exist concomitantly, triggering and perpetuating the clinical picture of TMD and making it difficult to identify a single causal factor for each patient (4). TMD symptoms have been observed in adults and adolescents who suffered facial and neck trauma (4, 5). The most common signs and symptoms in TMD are facial pain during mandibular function, joint noise, and limited mouth movements (6).

Facial trauma in sports has been associated with TMD (7). Sports activities generate stronger, more frequent forces than normal day-to-day activities. The practice of sports is responsible for six times more facial trauma than workplace accidents and three times more facial trauma than violence or traffic accidents (8). Significant forces transmitted to the soft tissues of the TMJ and supporting structures can result in severe dysfunction (9). TMJ injuries have been reported to be the second most common type of injury in sports activities (13.4%), after soft-tissue lacerations and contusions (10).

In general, professional or high-performance athletes differ from amateur (or recreational) athletes in that they train more frequently and more intensely. High-performance martial arts practitioners in particular participate at a level that involves a high degree of competition and aggression. This relationship between the level at which an athlete competes and the frequency of injuries is also described in the literature (11, 12). Because of the intensity and duration of training needed for elite-level competitions, high-performance athletes can have two to five times more traumatic injuries than recreational athletes (12). One study found that 79.2% of an elite group of boxing, taekwondo, kickboxing, and Muay Thai athletes had at least one
facial lesion due to trauma that required medical care during the year prior to the study and that 6.7% of these were diagnosed as mandibular dislocation (13).

There are few studies describing the prevalence of TMD in different types of sports. One study found that 30% and 16.7% of football players in Barcelona F.C. presented with bruxism and joint noise, respectively, and that 6.7% of these reported pain on joint palpation (14). Other authors reported a prevalence of TMD in football players of 27% (15). In scuba divers, the prevalence of orofacial pain was 44% and TMJ-related pain was 16% (16).

There is a dearth of information on the association between TMD and sports activities. Furthermore, existing studies generally use unvalidated questionnaires and non-reproducible criteria to diagnose TMD (14, 15, 17). In light of this, this study sought to investigate the prevalence of TMD in high-performance martial arts practitioners and compare it with the prevalence in recreational athletes and non-athletes.

Material and methods

The study was a cross-sectional observational study and was approved by the Federal University of Paraná Research Ethics Committee under reference number 12361611110.

The study population consisted of athletes from the Brazilian karate-do team (group I), amateur karate-do athletes (group II), high-performance mixed martial arts (MMA) athletes (group III), and individuals who do not practice martial arts (group IV). Groups I and III therefore consisted of high-performance martial arts practitioners. To be included in this group, athletes had to have been practicing martial arts at a professional level for at least 1 year. Group II was made up of amateur-level martial arts practitioners. To be included in this group, individuals had to have been practicing martial arts for at least 1 year without taking part in competitions. To be included in any of the groups, athletes had to be over 18 years.

All the individuals who met the selection criteria were told about the objectives, procedures, risks, and benefits associated with the study and signed a voluntary informed-consent form.

The validated Portuguese version (18–20) of the RDC/TMD (Research diagnostic criteria for temporomandibular disorders) (21) was used. The RDC/TMD is a tool for the epidemiologic investigation of TMD. It allows to evaluate not only the prevalence of the signs and symptoms of TMD in a population but also the number of people with a diagnosis of TMD to be determined. It also allows a diagnostic classification to be established based on the different subtypes of TMD and the chronic pain status associated with TMD to be quantified.

Axis I of the RDC/TMD is a physical examination used to diagnose TMD. The diagnosis of muscle pain is based on the algorithm for diagnosing muscle pain. Myofascial pain is diagnosed when the patient presents with more than three ipsilateral muscle sites sensitive to palpation. A diagnosis of joint pain associated with TMD is made with the RDC/TMD algorithms for joint pains. Disk displacement with arthralgia is diagnosed when pain is present on joint palpation on the same side as the joint clicking (as long as this is eliminated by protrusive opening) or on the same side as the deviation with reduced opening (difference between unassisted opening and assisted opening < 5 mm). The presence of joint pain in association with coarse crepitation leads to a diagnosis of osteoarthritis. According to the criteria in the RDC/TMD, an individual may present with more than one TMD subtype. Axis II of the RDC/TMD consists of a health and behavior questionnaire and allows pain to be classified according to its intensity and the limitations it imposes. Individuals reporting pain intensity of <50 points on a visual analog scale (VAS) of 0–100, in which 0 indicates an absence of pain and 100 unbearable pain, and disability of <3 points according to the RDC/TMD are classified as having grade I chronic pain (low-disability and low-intensity pain). Patients are classified as having grade II chronic pain (low-disability and high-intensity pain) when they report pain intensity of >50 points and disability of <3 points. Grade III chronic pain (high disability and moderately limiting) corresponds to disability scores of 3–4 points regardless of pain intensity. Grade IV chronic pain (high disability and severely limiting) corresponds to disability scores of 5–6 points regardless of pain intensity.

The physical examination was performed in accordance with Axis I by a specialist in TMD and orofacial pain trained in the RDC/TMD. Self-reported symptoms compatible with the findings of the RDC/TMD index were considered an important criterion for establishing the diagnosis of any TMD subtypes. The following variables were assessed: prevalence of TMD; frequency of TMD subtypes; degree of chronic pain associated with TMD; and symptoms associated with TMD. All participants filled out the Axis II (behavioral) questionnaire so that self-reported facial, jaw, temple, and ear pain in the previous month could be identified. The presence of symptoms frequently associated with TMD was also recorded (clicking, crepitus, tooth clenching, uncomfortable bite, morning stiffness, and buzzing ears) (21).

The data were recorded in tables and analyzed with SPSS 19.0 (SPSS Inc, Chicago, IL, USA). The chi-square test was used to compare the prevalence of TMD and the degree of chronic pain in the two groups. When this indicated an association between the variables, the groups were compared pairwise for the difference between proportions using Statistica 12.0 (StatSoft Inc, Tulsa, OK, USA). A significance level of 5% ($P < 0.05$) was used for all the statistical tests.

Results

The 24 high-performance karate-do practitioners in group I consisted of 17 (70.8%) men and 7 (29.2%) women with an average age of 28.3 (±7.9) years who had been practicing karate-do for an average of 11.8 h week$^{-1}$ for 19.9 (±6.6) years.
Group II consisted of 17 karate-do practitioners broken down as follows: 13 (76.5%) men and 4 (23.5%) women with an average age of 24.7 (±5.7) years. They reported having practiced karate-do for an average of 7.8 h a week for 8.9 (±4.7) years.

Group III consisted of 13 professional MMA athletes broken down as follows: 10 (76.9%) men and 3 (23.1%) women with an average age of 24.9 (±5.3) years. They had been practicing for an average of 7.4 h a week for 7.8 (±2.3) years.

Group IV consisted of 28 individuals who did not practice contact sports regularly and volunteered to take part in the study. The group was broken down as follows: 20 (71.4%) men and 8 (28.6%) women with an average age of 22.6 (±2.5) years.

Variances between the groups for the variable gender were homogeneous (P > 0.05). For the variable age, variances were homogeneous between groups I, II, and III (P > 0.05). Group IV had a significantly lower mean age than group I (P = 0.01).

The prevalence of TMD in each group is shown in Fig. 1. In groups I and III, there was a higher prevalence of TMD than in group IV. This finding was statistically significant (P = 0.003; +P = 0.002).

Table 1 shows the degree of TMD-associated chronic pain in the various groups. The results for groups I and III were significantly different from those for group IV (P = 0.0014 and P = 0.0015, respectively).

Figure 3 shows the frequency of symptoms commonly associated with TMD for each of the groups according to the RDC/TMD.

Discussion

As facial trauma can be associated with the appearance of TMD symptoms and as high-performance athletes have more traumatic lesions than recreational athletes and non-athletes (22), this study sought to identify and compare the prevalence of TMD in high-performance martial arts practitioners with the prevalence in recreational athletes and non-athletes. The prevalence proved to be higher in professional athletes than in amateurs or non-athletes. Disk displacement was the most common TMD subtype among high-performance martial arts practitioners. The majority of athletes diagnosed with TMD presented with grade I chronic pain, corresponding to low-intensity, low-disability pain.

The intensity with which high-performance athletes train and their consequent continual exposure to facial trauma, anxiety, and stress appear to be important factors in the high prevalence of myofascial pain and disk displacement in professional athletes in this study (groups I and III), as the prevalence of the conditions in recreational martial arts practitioners (group II) was similar to that in non-athletes (group IV) (Fig. 1).

Disk displacements, the most common TMD in this study, have their etiology in structural damage to the ligaments of the disk (23). Face and neck trauma can be directly related to the origin of this TMD subtype. Hence, high prevalences of disk displacement in a population with considerable exposure to facial trauma are not unexpected. Disk displacements are also common in the population at large (24) but are usually considered subclinical as they are not accompanied by pain or impaired mandibular function. In this study, individuals diagnosed with disk displacement according to the RDC/TMD presented with facial pain, particularly during mandibular function. Our results corroborate those of Shirani et al. (13), who reported that lesions due to facial trauma are significantly more frequent among professional athletes than among amateurs although sports-related orofacial injuries occur during
organized athletic events as well as in recreational events. Hence, existing data on the prevalence and incidence of sports-related trauma may tend not to be reported (25).

We chose to use the RDC/TMD in this study as it allows not only the presence of signs and symptoms of the condition to be identified but also the condition to be classified into one of the various TMD subtypes and the associated chronic pain status to be assessed. In our study population, grade I chronic pain, that is, low-intensity, low-disability pain, was observed more frequently in athletes with myofascial pain and disk displacement (Table 1). This finding can be explained by the athletes’ frequent exposure to pain as a result of their training and competition routine, leading to less catastrophizing of painful experiences and reducing the risk of chronification of pain (26).

The prevalence of the signs and symptoms of TMD observed in the present study (Fig. 3), although high, should be interpreted with caution as other studies have shown that the symptoms of this condition are common in healthy individuals (24, 25). One study, in which male adolescent athletes (n = 46) and non-athletes (n = 41) who played basketball underwent a physical examination and completed a self-assessment questionnaire, failed to find any significant differences between the two groups in terms of maximum mouth opening, pain during mouth opening, clicking, pain on palpation of the masseter, temporalis, sternocleidomastoid or trapezius muscles, otalgia, tinnitus, tooth clenching, bruxism, unilateral mastication, or deviation during opening and closing. The authors suggested that the absence of significant differences may have been due to the protective action of the testosterone levels in male athletes (27). The absence of a validated, reproducible protocol makes it difficult to compare these findings with the results of our study. Studies that seek to identify the presence of TMD should preferably use tools that allow a diagnosis to be made in addition to identification of the symptoms. The use of the RDC/TMD in this study makes the prevalences of TMD observed here all the more worthy of note (Figs 1 and 2).

Although the results are significant, any analysis of them must take into account the small sample size. Further studies of TMD in larger groups of high-performance martial arts practitioners using the same precise methodological diagnostic criteria are needed. Our findings indicate that educational campaigns and preventive measures should be drawn up and implemented to reduce the very high prevalence of myofascial pain and disk displacement among athletes.

Acknowledgements

The authors would like to thank Dr. Sergio Ignacio for his dedication to the statistical analysis of the data.

References


