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ORIGINAL ARTICLE

Spinal and temporo-mandibular disorders in male workers of the State Police

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Abstract

Objective. The aims of this study are to evaluate the prevalence of disorders of the lumbar region and the temporo-mandibular district co-morbidity in drivers and workers of the State Police employed for different office activities ***Materials and methods.*** The study population included 103 drivers as cases and 100 police officers as controls. The study was carried out through questionnaire and clinical evaluation of the spine and temporo-mandibular region. ***Results.*** At clinical examination, the drivers were found to have a higher prevalence ($p < 0.05$) of both symptoms and clinical signs at the spine and temporo-mandibular joint (TMJ), when compared with the controls. The results also showed a higher prevalence ($p < 0.05$) of co-morbidity in the two districts among the drivers, when compared with the controls. ***Conclusions.*** These results confirm that morbidity related to back and TMJ and increase in co-morbidity between the two districts are higher in professional drivers.

Key Words: *lumbar region, posture, TMJ, whole-body vibration*

Introduction

Musculoskeletal disorders of the cervical and lumbar tract of the spine represent a frequent cause of absence from work, causing socioeconomic damage. According to the National Institute for Occupational Safety and Health (USA), these conditions have a second place in the list of the 10 most frequent health problems in workplaces [1]. In the US, low back pain causes an average of 28.6 annual days of sick leave among every 100 workers. In Italy, spine disorder is the most common disease, according to repeated Istituto (Centrale) di Statistica (ISTAT) surveys on the health of population.

Several occupational factors play an important role in the onset of spinal disorders [2,3]. Some workers have higher risk of developing low back pain than those who render light works with changes in posture; workers in heavy industries, drivers, farmers, construction workers, dentists, nurses and Municipal Policemen [4–9] as well as those with prolonged fixed postures, who handle heavy loads or are subjected to repetitive activity of the upper limbs are particularly vulnerable [10–13].

Although literature is not unanimous, professional drivers seem to be exposed to the risk of low back pain and spinal disorders because they are exposed to whole-body vibration (even if at low levels) and several ergonomic risk factors [14,15]. In line with this concept in some cross-sectional studies on 633 drivers of vehicles, Backman [16] observed an increase in the frequency of musculoskeletal disorders in the neck-shoulder-back districts, linearly correlated with age.

In addition to age, other non-occupational risk factors, such as sex and body mass index (BMI), seem to be involved in the genesis of diseases and disorders of the spine. In recent years, many studies have investigated the relationship between stomatognathic system, body posture [17] and the presence

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of pathology and disorders of the lumbo-sacral district [18–20].

The stomatognathic system is the functional whole of skeletal components, dental arches, soft tissues, temporo-mandibular joints (TMJ) and masticatory muscles. Together with the cervical zone, this structure forms the cranio-cervical-mandibular system [21–23]. The stomatognathic district disorders are considered as one of the most important factors that could affect the body posture. Several studies have documented the relationship among TMJ, shoulder joint, neck, and spine [18,24–26].

Symptoms in these regions can have:

- an ascending character (from the knee to the hip, the shoulder and then TMJ); or
- a descending character (with cascade transmission from TMJ to the other neuromuscular chains) [27].

The aims of our study are as follows:

(1) To evaluate the prevalence of symptoms involving the lumbo-sacral spine and TMJ and the presence of clinical signs of lumbo-sacral spine commitment and TMJ effort at physical examination.
(2) To evaluate the presence of co-morbidity of the lumbo-sacral tract and the temporo-mandibular district.

These parameters were studied in two groups of workers of the State Police employed for different tasks:

- A group of professional drivers exposed to several well-known non-ergonomic factors for posture and whole-body vibration; and
- A control group of employees carrying out office activities and not exposed to the above-mentioned factors.

Materials and methods

All the subjects of this study were males who were recruited among employees of the State Police.

From the total number of male employees of the Italian Police Department (10000 employees), 2000 subjects were randomly selected. Three hundred and forty-five of them were drivers and 1655 were employees carrying out tasks that did not involve the use of vehicles. Information on age, length of service, height and weight (to calculate the BMI) were collected for each employee as well as information about the non-occupational exposure to risk factors for low back disorder, such as heavy physical activities including weight lifting, time spent driving cars outside service or driving motorcycle and heavy vehicles and sports (such as horseback riding, cycling or road running). These activities and anamnestic characteristics, such as previous traumas or fractures, osteomuscular diseases, disc herniation, congenital or acquired dislocation of TMJ, deficiency malformations of articular ends, previous lock and malocclusion with sagittal or transverse translations, were considered as exclusion factors.

From the original group of 345 drivers, only 103 policemen (cases) involved in operative work shift for driving a car were selected (on an average, 7 h per day). From the original group of 1655 police, only 100 policemen (controls) not involved in driving vehicles, not positive to the exclusion factors and comparable with the group of cases by age, seniority and BMI were included in the study. The controls were mainly engaged in office work with various tasks, such as assessments for external offices (tribunal, finance office, etc.), performance of administrative dossiers, archiving, certification, database monitoring, secretarial activities and filling in forms Cases and controls were comparable by age, length of service and BMI. The characteristics of the study population are shown in Table I.

The assessment instruments used were as follows:

- A medical questionnaire; and
- Physical examination of the temporo-mandibular district and spine.

The questionnaire used for the aims of our study had been developed by our team. Several literature-standardized questionnaires to study the TMJ and spine functions are highly specific (composed of questions about the disorder etiology, occurrence, length and intensity of pain, pharmacological therapy, etc.) and so not useful to our aim.

Our questionnaire consisted of six items investigating the presence of the main disorders of TMJ and lumbar region during the previous year:

(1) TMJ pain;
(2) Feeling of heaviness in the lumbar region;
(3) Low back pain;
(4) Fatigue/discomfort in the lumbar region;
(5) Lumbar stiffness; and
(6) Co-morbidity of the following:

Table I. Characteristics of the study population.

	Cases (n = 103)	Controls (n = 100)
Age		
Mean (SD)*	35.8 (6.9)	34.8 (6.5)
Min–max	25–50	25–47
Length of service		
Mean (SD)*	10.8 (6.1)	9.9 (6.3)
Min–max	4–27	4–27
BMI		
Mean (SD)*	22.4 (1.6)	22.4 (1.7)
Min–max	18.6–24.9	18.6–24.9

*$p > 0.05$.

- TMJ pain; or
- Lumbar symptoms (feeling of heaviness and/or low back pain and/or fatigue/discomfort and/or lumbar stiffness).

Through spine physical examination, we evaluated the following:

(1) Spinal axis;
(2) Scoliosis and/or lumbar lordosis;
(3) Lower limbs asymmetry;
(4) The straight-leg-raising sign of Lasègue (pain on raising the leg extended at the knee) is one of the best known in neurology [28];
(5) Wassermann maneuver (passive extension of the leg while the patient is in prone position) [29];
(6) Retraction of erector spinal muscles;
(7) Ritchie index for TMJ (assessed for tenderness by pressure with the pad of the index finger over the joint margin or joint pain caused by passive movements). Tenderness was scored on a 4-point scale as in the Ritchie index (0 = no tenderness, 1 = patient complained of pain, 2 = patient complained of pain and winced and 3 = patient complained of pain and winced accompanied by a movement of retraction) [30]; and
(8) Co-morbidity of the following:

- Positivity for Ritchie index; and
- Positive signs of spine engagement (positive Lasègue sign and/or positive Wasserman maneuver and/or retraction of erector spinal muscles).

The analysis was conducted on cases vs controls using prevalence and chi-square tests (χ^2). Data were presented as prevalence of symptoms.

Informed consent was obtained from all patients for inclusion in the study and all the data were collected and processed anonymously. The participants were specifically asked to adhere to the study and were individually informed about their results. All the data were collected and handled in accordance with the principles of the Helsinki Declaration.

Results

The prevalence of TMJ pain ($p < 0.001$) and heaviness in the lumbar region, low back pain, stiffness and fatigue/discomfort in the lumbar region were significantly higher in drivers than in the controls ($p < 0.0001$). Physical examination of the spine showed a significantly higher prevalence of positive signs (Lasègue, Wasserman, retraction of erector spinal muscles) ($p < 0.0001$) and the Ritchie index ($p < 0.001$) in cases than in the controls. None of the cases and controls had abnormalities of the axis (scoliosis, lordosis, lower limb asymmetry) and these results are summarized in Table II.

Co-morbidity of the two districts (association between symptoms and pain in the lumbar region and temporo-mandibular district and between positivity of commitment signs of lumbar spine and positive Ritchie index) had a significantly higher prevalence in drivers ($p < 0.05$), when compared with employees carrying out office work. These results are summarized in Table III.

Discussion

Our results showed that the prevalence of all symptoms and signs of alteration evaluated through physical examination of the spine was significantly higher in drivers than in the controls. The correlation between prolonged driving and back pain disorders in professional drivers has been studied extensively by several authors and has been found to be associated with exposure to whole-body vibration and prolonged non-ergonomic postures [14,15]. It is known how these working risk factors act negatively on the spine,

Table II. Characteristics of the study population with spinal pain and temporo-mandibular disorders.

	Prevalence cases (n = 103)	Prevalence controls (n = 100)
Temporo-mandibular joint pain*	39%	15%
Feeling heaviness in the lumbar region**	73%	14%
Low back pain**	86%	24%
Lumbar stiffness**	73%	28%
Fatigue/discomfort in lumbar region**	79%	52%
Lasègue sign**	31%	2%
Wasserman maneuver**	31%	7%
Retraction of erector spinal muscles**	45%	7%
Positivity for Ritchie index for TMJ*	31%	14%

χ^2 test.
*$p \leq 0.001$; **$p \leq 0.0001$.

Table III. Characteristics of co-morbidity in the study population.

	Prevalence cases (n = 103)	Prevalence controls (n = 100)
Comorbidity of*: Temporo-mandibular joint pain; lumbar symptoms (feeling heaviness and/or low back pain and/or fatigue/ discomfort and/or lumbar stiffness)	78%	33%
Comorbidity of*: positivity for Ritchie index; positive signs of spine engagement (positive Lasègue sign and/or positive Wasserman maneuver and/or retraction of erector spinal muscles)	58%	27%

χ^2test.
*p < 0.05.

being the cause or con-cause of lumbar spine disorders.

Our results also showed a significantly higher prevalence of TMJ pain and TMJ effort (the positivity of Ritchie sign) in drivers than in the controls. We believe that, to date, the prevalence of these disorders in this occupational category has not been completely investigated in the literature. In light of what has been observed in our cases and controls, which were comparable for a few background variables (Table I), it can be hypothesized that the task of a driver (with well-known risk factors, such as total-body vibration and non-ergonomic prolonged postures) can have negative effects, causing temporo-mandibular district disorders.

Our study also showed a significantly higher prevalence of co-morbidity between the lumbar district and the TMJ in drivers than in the controls ($p < 0.05$). The association between the two districts in the general population has been considered in the literature but never in this category of workers or in the field of occupational medicine.

The role played by the presence of TMJ axis disorders on posture in the general population is well known and the presence of disorder symptoms of this district is believed to be the source of postural alteration likely to cause spine disease [18,31–34] in descending cascade. An ascending relationship between the two disorders also is possible. Wiesinger et al. [35] showed that subjects with long-term neck, shoulder and back pain suffer from temporomandibular disorders more often than the controls. There are evidences on the role of temporo-mandibular disorders and the risk of developing postural alteration; unusual position in body posture can cause spinal pain. Some studies also support the role of trigeminal afferences and dental occlusion in postural control [17,36,37]. Gangloff and Perrin [38] suggested the influence of periodontal receptors on body posture. Several studies maintain that a change in the mandibular position by periodontal and proprioceptive afferences may influence postural stability [32,39].

However, the results of our study show that the simultaneous presence of these two types of disorders is higher in drivers than in office workers.

Therefore, we can hypothesize an influence of the job also on the prevalence of co-morbidity between the lumbar and temporo-mandibular district, although we cannot determine the sequence (ascending or descending) phenomena; these data deserve to be further investigated.

It must be underlined that possible selection bias may be determined by the limited sample size, small European geographical area (Italy) and lack of heterogeneity in the controls' task (because all workers are sedentary clerks). The limitation of our study is in the use of a questionnaire, which, although administered by a physician, provides subjective responses. To minimize this limitation and to integrate and validate the information obtained, each employee underwent physical examination.

In the context of occupational medicine, there are only a few studies on the relations of temporomandibular pathology with factors of occupational origin. It can be assumed that, in drivers, the risk factors act on the spine and temporo-mandibular district and determine co-morbidity.

In the context of occupational medicine, our results suggest the use of protocols for monitoring not only the musculoskeletal system but also the temporomandibular region. These protocols may be applied to assess early signs of work-related diseases. The anamnestic clinical monitoring of the TMJ system, together with adequate information on the correct position in driving, the use of rear-view mirrors to avoid spinal rotations, and so on, may be useful in reducing the risk of very common disorders, such as muscle-tensive headache associated with the craniocervical-mandibular system, which can become quite dysfunctional because of frequent absence from work.

Declaration of interest: The authors report no conflicts of interest. The authors alone are responsible for the content and writing of the paper.

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