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Joint Proprioception of Adolescent Idiopathic Scoliosis: A Mini Review

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ABSTRACT

Adolescent idiopathic scoliosis is reported that associated with proprioception defects. This article is to perform a review about the research status of joint proprioception in adolescent idiopathic scoliosis.

Keywords: Proprioception; Adolescent Idiopathic Scoliosis; Joint; Spine

Abbreviations: AIS: Adolescent Idiopathic Scoliosis; JPS: Joint Position Sense

Introduction

Adolescent Idiopathic Scoliosis (AIS) is a complex three-dimensional spinal structure disorder of unknown etiology and commonly found in adolescents aged 10-16 years old [1]. AIS can be diagnosed as a lateral curvature of the spine in the frontal plane at least 10 degrees accompanied by vertebral rotation on standing radiography for which no directly causes could be established [2]. The progression of scoliosis can cause severe spinal deformity, which not only affects the physical appearance of patients, and leads to many adverse consequences, but also brings huge pressure to the patient's family [2,3]. Proprioception is known as the afferent signal originating from joints, muscles, tendons, and associated deep tissue mechanoreceptors [4]. The central nervous system then processes proprioception to generate proper neuromuscular efferent signal [5]. An intact proprioceptive function is essential for normal movement control. Previous literature has reported that AIS patients may have proprioceptive dysfunction, which may be related to the initiation and progression of scoliosis [6,7]. This review aims to discuss the latest research status of joint proprioception in AIS patients, which can provide some implications to help patients control disease progression.

Discussion

Peripheral Joint Proprioception Disorder

The proprioception of peripheral joint of AIS has been evaluated by several studies. Most of them Joint Proprioception of Adolescent Idiopathic Scoliosis: A Mini Review. believed that AIS patients have peripheral joint proprioception disorder. In the '80s, Yekutiel et al. [8] performed passive elbow and knee joint position sense test in AIS (age: 10-16 years, spinal curve: 10-41 degree, n=24) and normal children (n=70). However, they found there was no significant difference in Joint Position Sense (JPS) between the AIS patients and the control group. In addition, they found younger scoliotics had better elbow joint proprioception, but older scoliotics had worse elbow joint proprioception. Therefore, it was likely that poor joint proprioception was more an effect of developed scoliosis than a cause. Barrack et al. [9] compared the difference in JPS of

the knee between the AIS (average age:14.8 years, average spinal curve: 26.8 degree, n=17) and healthy controls (n=12). They used the target angle reproduction and the threshold for detection of joint motion tests to measure JPS of the knee joint and found that AIS had a significant bad ability to reproduce knee angles and detect the change in knee angle.

Cook et al. [10] used the similar test procedures to measure the JPS of the elbow joint and found that AIS (age:10-16 years, average spinal curve: 34-degree, n=23) performed worse than the control group(n=18) in both threshold and angle reproduction tests. Barrack and Cook et al. reached a similar conclusion that AIS may have proprioceptive function deficit but the location of damage in the neural pathway cannot be determined. Keessen [11] conducted an upper-extremity spatial orientation test to measure the upper-extremity proprioceptive accuracy of AIS patients (average age: 14.2 years, average spinal curve:35 degree, n=25), spinal asymmetry subjects (average age: 13.2 years, average spinal curve:12 degree, n=40) and healthy controls (average age: 13.7 years, n=134). Their findings suggested that both AIS patients and spinal asymmetry groups showed significant proprioceptive inaccuracy in the upper extremity. In their opinion, proprioception disorder could be a reasonable contribution factor to spinal deformity. In conclusion, although it cannot to determine whether the change of joint proprioception is a cause of an effect of spinal deformity, and also cannot to speculate about the location of the deficit, previous studies did find that AIS do have some degree of peripheral joint proprioception disorder [9-11].

Spinal Proprioception Disorder

It has been proposed that AIS patients may perceive nonerect vertebral alignment as straight mistakenly, which may contribute to the occurrence of the abnormal spinal curve [12]. For the spine, the paraspinal muscles, ligaments, facet joints and intervertebral can produce the proprioceptive information about the spatial position and movement of the spine [13]. In that background, attention should be paid to the spinal proprioception function in AIS patients. However, so far there is no much information about spinal proprioception in AIS. The latest related research assessed the cervical proprioception in AIS by cervicocephalic relocation test, and found that without visual and vestibular input, some AIS patients had impaired ability to relocate their head on trunk accurately after an active movement of the head [7]. Cervical proprioception has a strong connection with the orientation of the physical vertical [14] so that the authors believed that the abnormal cervical proprioception may aggravate the progression of AIS. However, the causal relationship between the spinal curve and impaired cervical proprioception was still not directly established. Further research is needed to supplement the detailed information about spinal proprioception of AIS.

Conclusion

Joint proprioception dysfunction in AIS patients refer to peripheral joint or spine is well-supported by many studies, but there is still some confusion about the relationship between proprioception and scoliosis. The joint proprioceptive dysfunction may aggravate the symptoms and prognosis of Joint Proprioception of Adolescent Idiopathic Scoliosis: A Mini Review. AIS. It is recommended to assess the joint proprioception function of AIS patients systematically in the clinical environment.

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