

Physical Therapy for Athletes Suffered from Vestibular Disturbances

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Abstract

System analysis of vestibular apparatus under exercise stress during training process of athletes with vestibular disturbances was carried out. Correlation between regulatory mechanisms, muscles functional capacities, and locomotor apparatus was studied. Knowledge on the means of restoration of athletes with vestibular disturbances was supplemented. Administration of physical rehabilitation of athletes with disabilities, subject to the main pathology due to which disability had been obtained, was substantiated. Application of special exercise therapy was optimized and the technique of correctional massage for athletes with auditory analyzer dysfunction was elaborated. Means of physical therapy are intended for maintenance, partial restoration of lost vestibular associative bonds, training of adoptive mechanisms to respond to the stimuli of the environment.

The indices of acumetry at the beginning and at the end of the study, after commonly used recovery facilities application and means of rehabilitation administration were investigated. Whispered language indices in the control group by the end of the study improved by 11.91%; spoken language indices improved by 9.52%. In the experimental group these characteristics improved by 6.04% and 5.25% correspondingly. The necessity for vestibular adaptive correction in athletes with disabilities in compliance with the factorial analysis was proved.

Keywords: Acumetry; Massage; Hearing Impairment; Athletes with Disabilities; Physical Therapy

Introduction

At the present stage of the community development the significance of motor activity increases dramatically [1,2]. Motor performance nowadays not only preserves the conditions for living activities, but also enhances operational capacity, furthers the development of cerebral cortex, contributes to the intercentral connections coordination, helps to maintain motor interactions of analyzer systems and cognitive processes [3,4]. The results of the effect of regular physical activity on individuals belonging to various age categories are adduced in the publications of Alenka Fidler, *et al.* (Fidler 2017). The authors claim that regular physical activity improves general well-being, reduces the risk of many diseases, strengthens bones and muscles, normalizes arteriotony, slows down the pulse, increases the lung capacity, improves the immune system, helps to maintain equilibrium state, enhances psychophysical capabilities, and exerts a positive

impact on wellness and quality of life [3,5,6]. For people with disabilities doing sports creates prerequisites for successful life, restores psychological equilibrium, allows returning to a full-fledged life despite certain physical impairments [7,8]. Since athletes with disabilities of various nosological forms of diseases often experience vestibular apparatus disturbances, they possess significant deviations in locomotion and movements generating sphere [7,9]. Problems of rehabilitation of persons with vestibular disorders are elucidated in the studies of V.T. Palchun, L.A. Luchikhina, O.M. Doronina (2009). They introduced a game method of performing physical exercises on stabilometer platform. V.V. Khramov (2008, 2010) determined the role of physical activities and sports in physical therapy of disabled athletes, as well as the role of exercise in improving the living standards of impaired individuals. Available publications are lacking information about any research that tackle the issues pertaining to physical rehabilitation of athletes with disabilities with dysfunctions of auditory analyzer. In view of the abovementioned, provision and improvement of rehabilitation measures, enhancement of the adaptability of athletes with disabilities, who have dysfunctions of auditory analyzer, became the subject of our research.

Materials and Methods

Organization of the research. The study was carried out at the training centers of National Teams of Ukraine. The study involved 32 qualified athletes with disabilities (N = 32: 16 persons - Control Group (CG) and 16 athletes - Experimental Group (EG)), who have the following dysfunctions of auditory analyzer: otosclerosis, tympanosclerosis, adhesive otitis, chronic sensorineural deafness on one ear, vestibulopathy, chronic sensorineural hearing loss, chronic secretory otitis (Ethics Committee of the Lviv National Medical University named after Danylo Halytskii, minutes No 2 of February 16, 2015). EG disabled athletes were trained according to the authoring individually suited physical therapy programs, whereas the CG athletes were trained according to conventional methods recommended by medical training centers. The studies lasted for 10 months.

Methods of research

Theoretical analysis of special methodological publications, acumetry method; biomedical method of acumetry; statistical data obtained by means of descriptive statistics with the help of Microsoft Excel for Windows, SPSS 10 for Windows, Statistica 6.0. Software.

Objective of the Research

To substantiate the expedience of physical rehabilitation means to improve the vestibular apparatus state in order to increase the functional capabilities of athletes with disabilities.

The Research Results

Functional examination of auditory (acoustic) or statokinetic (vestibular) analyzers is an unconditional requirement for estimation of physical rehab effect upon organ of hearing. Hearing function investigation should answer the following questions: whether the patient's hearing meets the norm; in case the hearing impairment is noted, then in what part of the hearing organ is the cause of the dysfunction [9]. Proceeding from the abovementioned we applied subjective methods of research (acumetric ones), studying the ability to hear and comprehend speech (whispered and spoken).

The MG athletes trained according to the authors' rehab program, performed special exercises, used correctional massage alongside with self-massage [10]. The CG athletes underwent commonly used means of rehab, recommended by medical units of training centers [5,6].

At the beginning of the study EG athletes showed the following indices of whispered speech (WS) and spoken speech (SS): WS - 1.93m; SS - 5.25m. The WS and SS indices of the CG athletes were as follows: 1.49 m for WS and 4.0m for SS (Figure 1).

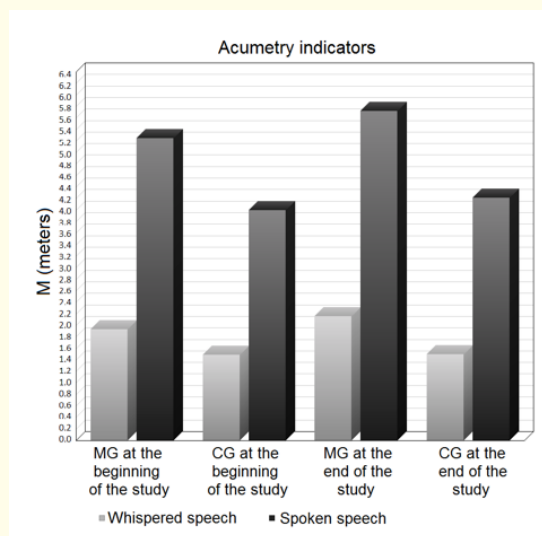


Figure 1: Indicators of acumetric study of hearing by means of speech test in athletes with disabilities with auditory analyzer dysfunction. $n = 32$; $p > 0,05$.

By the end of the study these indicators had changed towards improvement: WS index in EG athletes made up 2.16m, and SS index increased to 5.75m, that is, the whispered speech index in the EG grew by 11.91%, and SS index increased by 9.52%. In the CG the WS index was 1.58m and SS index was 4.21m, which indicated the increase of whispered speech index by 6.04% and spoken speech index - by 5.25%. The whisper speech index in EG athletes with disabilities exceeded the same index of the Control Group by 5.87%, and spoken speech index - by 4.27%, but this discrepancy turned to be statistically insignificant ($p > 0,05$).

Discussion

Describing physical development of persons with hearing analyzer dysfunctions, the authors observed that hearing impairments slow down the natural sequence of physical development [4,7]. The necessity of personalizing the functional state indices of neuromuscular and sensory systems of Paralympic athletes for further adjustment of physical loadings during training and competitive activities received its scientific validation [3,6,7]. A positive factor that facilitates competitions of athletes with disabilities is the availability of international dactylogy system, which allows athletes to communicate without interpreters [2,4].

The results of acumetric testing of hearing by means of speech tests were compared to the results of tuning-fork trials (Rinne and Weber's tests), conducted by otorhinolaryngologists and taken from medical records of athletes with disabilities with vestibular analyzer dysfunctions. Weber's test proves that in patients with sound-pick up apparatus lesions, i.e. with sensory-neural hearing loss, acoustic oscillations are better perceived by a healthy ear, or by the ear with sound-pick up apparatus affected to a lesser extent. Thus, one could observe lateralization to a healthy ear or to the ear, the sound-pick up apparatus of which has been preserved better (left or right lateralization). In patients with acoustic conduction lesions (conductive deafness cases) causes the tuning-fork sound lateralization to the sick ear, or, in case of bilateral lesion, to the ear with worse hearing [9].

Rinne test consisted in comparing the perception time of the sound of tuning-fork, brought near the external acoustic passage (air conduction), and the same tuning-fork placed against mastoid (bone conduction). In patients with conductive hearing loss the time needed

for the perception of sounds conducted through bone exceeds the time needed for the perception of sounds conducted through air. It is considered to be "negative" Rinne (R-). The matter is that in case of conductive hearing loss the perception of the sounds conducted through air is getting worse, and vice versa, the perception of the sounds conducted through bone takes a turn to the better.

Tuning-fork trials confirmed the results obtained by means of acumetric study (perception of whispered and spoken speech). Working out records of testing in a dynamic format enabled us to analyze and adequately plan physical rehab measures for athletes with hearing impairments. Regardless of the kind of sport the athletes did, attention was paid to the development of vibratory sensations by means of special exercises. Exercises were administered to all groups of muscles, observing the principle of sequence. Side bending and trunk twisting exercises were of special importance. Due to vibratory sensitivity a person can differentiate signals by their force and frequency, can discern different types of vibration. Self-massage technique, having a corrective purpose, improves flexibility and elasticity of tympanic membrane and auditory bones; enhances metabolic processes and auditory organ blood supply [10]. The effectiveness of the abovementioned physical rehab means and modalities was confirmed by registration and analysis of audiograms taken down otorhinolaryngologists from athletes with disabilities with auditory analyzer dysfunctions. Physical loadings applied by athletes with disabilities with auditory analyzer dysfunctions during training sessions were adequate, and the degree of hearing impairment remained almost unchanged both in the comparative group and the main group.

Conclusion

The results of the research indicate positive effect of the elaborated by the authors means and modalities of physical therapy on the vestibular adaptive corrections of athletes with disabilities with auditory analyzer dysfunctions. We can recommend applying physical rehabilitation means for athletes with disabilities including special exercises meant for adaptive capabilities development and partial restoration or preservation of auditory analyzer functions.

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