DENTAL STATUS OF NON-CONTACT SPORTS ATHLETES

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The relationship between dental status of athletes involved in non-contact power sports and their professional level was studied. Data on 60 young men were analyzed, divided into three groups: group 1 (n=20) included non-professional athletes, group 2 (n=20) professionals, and group 3 (control, n=20) men, not engaged in sports. The examination included interviewing and determining dental status, as follows: caries intensity (KPI index (h)), oral hygiene status (OHI-S scale), periodontal status (PBI, PMA, PI indices), microvasculature status (V.I. Kulazhenko test) and viscosity of mixed saliva (according to T.L. Redinova and A.R. Pozdeev). In professional athletes, compared with amateurs, more pronounced deviations of dental status were revealed, i.e. by the PMA index 1.7 times, by the bleeding index (PBI) 1.2 times, by the PI index 1.2 times, and by Kulazhenko sample 1.2 times ($p<0.05$); saliva viscosity after training was 1.3 times higher than that of non-professionals ($p<0.05$), which could be associated with intense physical and psycho-emotional stress and consequential impairment of the water-electrolyte metabolism. Non-contact sports athletes demonstrated low alertness regarding the occurrence of dental pathology, and there was a high degree of dental status disorders.

Key words: dental status, periodontal status, athletes, saliva viscosity, strength sports

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INTRODUCTION

The health of athletes plays an important role in the training process; it directly affects the body's response to physical activity, and athletic performance and results (1-3). Intense physical and psycho-emotional activities can cause the overtraining syndrome, affecting both the training process effectiveness and the health of the athlete (4-6). Significant physical and psycho-emotional activities deplete the body, affect the metabolism level, lead to an immunity decrease and contribute to suppression of the overall reactivity of the body. This may lead to the protein and electrolyte metabolism disorder, shifting the acid-base balance towards metabolic acidosis with respiratory alkalosis, the loss of calcium, phosphorus, potassium and fluorine. As a result, saliva acidity is increasing, and in combination with immunosuppression the microbial metabolism of the mouth is changing, creating conditions for demineralization of tooth enamel and reduced blood flow in the salivary glands (1,7-10).

There is a correlation between inflammatory periodontal diseases and functional disorders of athletes; moderate physical activity helps reduce the inflammatory periodontal diseases, while intensive activity serves as a factor for development of the disease (1,6). Those significant power loads lead to masticatory muscle hypertonicity, which causes temporomandibular joint problems and increases tooth abrasion. Psycho-emotional imbalance during the training period increases the bioelectrical activity of all masticatory muscles, especially of temporal lobe muscles, which is a poor prognostic factor for the longevity of restoration and leads to a growing number of abrasion teeth (1,5).

It is proved that intensive physical training changes the general immune state (increased interleukin-1 and

interleukin-8 deficiency) (11) and local oral immunity ⌈decreased levels of secretory immunoglobulin A (SIgA), lysozyme in saliva⌋ and electrolyte balance of salivary fluid, and as a result contributes to the development of inflammatory periodontal diseases (2). In addition, a number of studies have noted the effect of saliva viscosity on the state of oral cavity; its increase prevents the natural tooth cleaning and contributes to plaque deposition, while its decrease reduces the number of minerals and bicarbonates, thereby limiting the anti-caries activity of saliva (13). Not only excessive physical activity, but also various metabolites that accumulate in the body of athletes during the training process can inhibit the immune response (6,14).

In this context, it is interesting to study the correlation between the severity of dental system disorders and the professional level of athletes.

The purpose of this study was to assess dental status of athletes engaged in non-contact sports at different professional levels.

SUBJECTS AND METHODS

There were 60 young men aged 18 to 30 years in the survey. The study was designed according to ethical norms and laws of the Russian Federation and approved by the Department of Therapeutic Dentistry, Irkutsk State Medical University (head of the Department O. I. Tirskaya) by Protocol No. 7 of January 28, 2019. Before the study, the participants signed a voluntary informed consent for medical examination.

Exclusion criteria were acute inflammatory processes outside the oral cavity; severe cardiovascular, endocrine, and digestive system diseases; age (younger than 18 and older than 30); viral diseases in the oral cavity during the survey (acute and recurrent chronic herpetic infection) and refuse to participate in the study.

Depending on the athletic training level, the participants were divided into three groups. Group 1 (n=20) included non-professional athletes engaged in non-contact power sports for at least 5 years, using weights up to 100-150 kg up to one repeated maximum in a single exercise. Group 1 training was 1.5 hours 2 times a week. Their mean age was 25.8 years, median age 26 (min 23.75; max 27.25).

Group 2 (n=20) included professional athletes engaged in non-contact power sports for at least 5 years, using weights up to 100-150 kg up to one repeated maximum in a single exercise. Group 2 training was 1.5 hours 5 times a week. Their mean age was 25.5 years, median age 27 (min 24.0; max 27.0).

Group 3 (control group, n=20) included men who presented to the Department of Therapeutic Dentistry for treatment or professional hygiene. According to outpatient records, they did not have general somatic pathology and did not exercise regularly. Their mean age was 22.8 years, median age 20 (min 24.5; max 22.8).

Reproducible noninvasive, low-cost screening methods were selected for the survey. The study was based on a questionnaire about the interviewees' attitude to preventive examinations and the risks of developing dental pathology: do you believe that sports can have an undesirable effect on the teeth and/or gums condition; do you consult a dentist for preventive examination, and if so, how often; do you consult a dentist only for treatment in case of problems (yes/no); and what oral cavity problems you can relate directly to power sports.

All participants underwent comprehensive assessment of dental status, including caries intensity ⌈CPI (h) index⌋ and oral hygiene state (Green-Vermillion index, OHI-S). Periodontal status study included periodontal pocket depth assessment using a periodontal probe, pathological tooth mobility, degree of gum bleeding ⌈Muellemann-Saxer index (PBI)⌋, gum inflammation (PMA index), and degree of periodontal tissue destruction (periodontal index).

A modified vacuum sample of V.I. Kulazhenko helped assess the functional state of the microcirculatory bed and capillary reactivity. Using a portable AVLT-Gum device, after creating a negative pressure device in the system of 0.6-0.7 kg/cm^2, we applied an 8-mm diameter glass tip to the gum in the transitional fold area in the lower front teeth and recorded the time in which the hematoma appeared.

According to the method of T. L. Redinova and A. R. Pozdeyev, we evaluated the mixed saliva viscosity in dynamics in groups 1 and 2, before and after training (15). For this purpose, we collected 1-2 mL of oral fluid. The material was taken immediately before the study by spitting into sterile polypropylene tubes with a tightly closed lid. A calibrated pipette fixed in an upright position helped taking 1 mL of saliva and determine the saliva volume flowed from the micro-pipette in 5 seconds. Calculation of relative viscosity of mixed saliva (Ws) in relative units was performed using the formula:

$$Ws = Vв \times Wв/Vs,$$

where Vв is the volume of water (in mL), Wв is viscosity of water (equal to 1.0 Rel. units), and Vs is the volume of saliva (in mL).

Statistical processing was performed using Excel software (Microsoft Office 2010) in the Windows 7 operating system. The data obtained were processed using nonparametric methods of statistical analysis. The median and interquartile range (C25-C75 percentiles) were calculated. Intergroup differences on comparison of the two unrelated groups were evaluated using the Mann-Whitney U-test. The critical value of statistical significance level was at least 95% ($p<0.05$).

RESULTS

According to their history, only 25% of athletes (n=5) from group 1, 50% (n=10) from group 2 and 20% (n=6) from control group 3 had undergone preventive dentist examinations regularly. At the same time, a quarter of athletes from group 1 and 35% from group 2 did not exclude the possibility of dental system pathological processes due to intensive non-contact training background.

Dental status analysis of the participants revealed that non-contact sports professional athletes had the most pronounced disorders. Thus, caries intensity (according to the CPI index) was 9.0 (7.75-10.25). The indicators 'caries' and 'dental filling' were almost equal due to the high incidence of chipped restorations in this group of patients, which led to destruction of the filling permeability edge and therefore considered as the indicator 'caries'. For non-professional athletes (group 1), the CPI (h) was 8.5 (7.0-10.25), and the index structure was dominated by filled teeth. In the control group 3, the index was 8.0 (6.75-9.25), dominated by filled teeth.

Comparative analysis of periodontal status revealed the most pronounced changes in professional athletes (Table 1), where 11 (55%) participants had chronic catarrhal gingivitis, 8 (40%) had generalized early periodontitis and one (5%) had intact periodontal disease. The median value of the PMA index was 34.5% (29.5-45.25), which indicated the average severity of gingivitis in the majority of the group. More pronounced inflammatory phenomena were combined with a more significant decrease in capillary resistance indicators. Kulazhenko's sample in this group was 32.0 (18.8-40.0) seconds. The periodontal index (PI) corresponded to the moderate stage of the disease and amounted to 1.95 (1.6-5.13) points.

Table 1
Index and functional indicators of periodontal tissue condition (DI)

Parameter	Reference value	Group		
		Group 1 (n=20)	Group 2 (n=20)	Group 3 (control) (n=20)
Green-Vermillion, OHI-S (points)	0-0.6, good level of hygiene; 0.7-1.6, satisfactory 1.7-2.5, unsatisfactory ≥2.6, poor level of hygiene	1.2 (1.1-1.5)	1.3 (1.0-1.5)	1.2 (1.1-1.3)
Bleeding index (PBI) (points)	0 normal (no bleeding during probing) 1 spot bleeding 2 multiple spot or linear bleeding 3 interdental space is filled with blood	1.8 (1.6-2.4)[1]	2.2 (1.9-2.8)[1]	1.0 (1.0-1.13)
PMA (%)	0% normal ≤30%, low degree of gingivitis 30%-60%, average degree of gingivitis ≥60%, severe gingivitis	20.5 (18.8-27.0)[1,2]	34.5 (29.5-45.2)[1,2]	13 (0-20.3)
PI (points)	0 normal 0.1-1.5, initial and stage I of the disease 1.5-4.0, stage II 4.0-8.0, stage III	1.6 (1.4-2.6)	1.9 (1.6-5.1)[1]	1.1 (0-1.5)
Kulazhenko test (sec)	In the front teeth area, normal is 50-60 seconds	37.5 (27.5-42)	32 (18.8-40)[1]	39.5 (30.5-55.2)

1 = significant differences compared to control group ($p<0.05$); 2 = significant differences between group 1 and group 2 ($p<0.05$).

Periodontal examination of non-professional athletes (group 1) revealed chronic catarrhal gingivitis in 12 (60%), generalized periodontitis of mild severity in 5 (25%) and intact periodontitis in 3 (15%) subjects. The median value of the PMA index was 20.5 (18.8-27.0) and periodontal index (PI) showed a moderate stage of the disease – 1.6 (1.4-2.6) points; the Kulazhenko sample was 37.5 (27.5-42) seconds.

Periodontal status evaluation of the control group showed that 10 (50%) participants had signs of chronic generalized gingivitis, 3 (15%) had generalized early periodontitis, and 7 (35%) had healthy periodontal examination results. Inflammatory phenomena in periodontal tissues were less pronounced in this group; the PMA index at the time of examination was 13 (0-20.3)%, the bleeding index was 0.95 (0-1, 13), PI 1.15 (0-1, 5), and the Kulazhenko sample was 39.5 (30.5-55.25) seconds.

The hygiene index did not differ significantly among the three groups and corresponded to the average values reflecting a satisfactory level of oral hygiene.

Thus, comparative analysis of periodontal status revealed the changes to be most pronounced in professional athletes. Significant differences were recorded between group 1 and group 3. The PMA index was 2.6-fold (34.5 (29.5-45.25)% *vs*. 13 (0-20.3)%, respectively); bleeding index (PBI) 2.2-fold (2.25 (1.9-2.8) points *vs*. 1.0 (1-1, 13) points, respectively), and PI index 1.7-fold greater (1.95 (1.6-5.13) points *vs*. 1.15 (0-1.5) points, respectively), for the Kulazhenko sample – 1.2-fold greater (32 (18.8-40) sec *vs*. 37.5 (27.5-42) sec, respectively), $p<0.05$.

Assessment of saliva viscosity (Table 2) before training showed approximately the same values: 2.85 (2.58-3.25) c.u. for non-professionals and 3.0 (2.86-3.73) c.u. for professionals. After training, saliva viscosity increased 2.2 times in group 1 and 2.85 times in group 2, and the difference between the indicators was 1.3 times (6.35 (5.75-6.83) c.u. *vs*. 8.55 (8.05-9.33) c.u. ($p<0.05$).

Table 2
Viscosity indicators of mixed saliva before and after training (DI)

Parameter	Group 1 (n=20)	Group 2 (n=20))
Relative viscosity of saliva before training, c. u.	2.85 (2.58-3.25)	3.0 (2.86-3.73)
Relative viscosity of saliva after training, c. u.	6.35 (5.75-6.83)*	8.55 (8.05-9.33)*

*significant differences between group 1 and group 2 ($p<0.05$).

DISCUSSION

Recently, there is a growing interest in dental pathology prevention (4,7,16). The study results revealed that both professional and non-professional non-contact sports athletes were not really concerned about dental system pathological processes (2,4). The risk of acute maxillofacial injuries in these sports is much lower than in contact sports (hockey or wrestling), where, according to some data, it accounts for up to 25% of the total number of sports injuries (6).

Research results in recent years indicate a greater prevalence of major dental diseases in athletes than in people who do not engage in sports, which is associated with intense physical activities, psycho-emotional overstrain, suppressing both local oral immunity and overall body responses (5,6). Comparative analysis of dental profile revealed that despite the fact that the level of hygiene in all the subjects examined was the same and corresponded to the average (satisfactory) level, professional athletes had the highest values of the caries intensity index (CPI(z)). In addition, the indicators 'caries' and 'filling' were almost equal due to the high incidence of chipped restorations that lead to violation of marginal permeability of fillings. Non-professional athletes and subjects not engaged in sports (control group) had the index structure dominated by sealed teeth. The results obtained are consistent with other authors' data (6,9). Periodontal status also showed greatest deviations in professional athletes, i.e. gingivitis and moderate periodontitis signs (according to the PMA and PI indexes), pronounced bleeding disorders (PBI index), and a significant decrease in capillary resistance (Kulazhenko test). In addition, professional athletes had significantly higher saliva viscosity after training than non-professional athletes, which can be considered as an aggravating factor of imbalance in the oral cavity (13).

Thus, the results obtained made it possible to identify more significant dental status disorders in a professional group of athletes.

CONCLUSION

Non-contact sports athletes demonstrated low alertness regarding the occurrence of dental pathology; only 25% of non-professional athletes and 50% of professional athletes had regular dental examinations.

Examination of professional athletes showed a high degree of dental status disorders; more significant signs of gingivitis and periodontitis (according to the PMA and PI indexes), pronounced bleeding disorders (PBI index) and a significant decrease in capillary resistance (Kulazhenko test); saliva viscosity after training also increased more significantly than in non-professional athletes. The results obtained can be used in planning medical and preventive dental care for non-contact sports athletes.

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SAŽETAK

DENTALNI STATUS BESKONTAKTNIH SPORTAŠA

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Ispitivana je povezanost dentalnog statusa sportaša koji se bave beskontaktnim sportom i njihova profesionalna razina. Analizirani su podatci 60 mladih muškaraca podijeljenih u tri skupine: prva skupina (n=20) uključila je sportaše amatere, druga (n=20) profesionalne sportaše, a treća (n=20) je bila kontrolna skupina koju su činile osobe koje se ne bave sportom. U ispitivanju se koristio intervju i utvrđivanje dentalnog stastusa: intenzitet karijesa ⌈indeks KPI (h)⌋, higijena usne šupljine (ljestvica OHI-S), periodontalni status (ljestvice PMI, PMA, PI), stanje mikrovaskulature (test V. I. Kulaženka) i miješana slina (prema T. L. Redinovoj i A. R. Pozdeevu). Utvrđeno je da su profesionalni sportaši u usporedbi sa sportašima amaterima imali izraženija odstupanja dentalnog statusa: u indeksu PMA 1,7 puta, indeksu krvarenja (PBI) 1,2 puta, 1,2 puta u testu V. I. Kulaženka (p<0,05); viskozitet sline nakon treninga bio je 1,3 puta viši nego kod amatera (p<0,05), što se može povezati s intenzivnim fizičkim i psiho-emocionalnim stresom i posljedičnim poremećenjem metabolizma vode i elektrolita. Beskontaktni sportaši pokazivali su nisku svijest s obzirom na pojavu dentalne patologije, a postoji visok stupanj poremećaja dentalnog statusa.

Ključne riječi: dentalni status, periodontalni status, sportaši, viskozitet sline, sportovi snage