Analysis of the recovery period among highly qualified women-gymnasts after lower extremities injuries

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Abstract: Studying the recovery period of female gymnasts after a break, caused by injuries of the musculoskeletal system, we determined the periods of jumping exercises effectiveness. They were characterized by complexity and high amplitude of performance. In accordance with the level of sports qualification and the nature of the injury, there was a differentiated recovery of jumping elements indices. The study involved 5 female gymnasts born in 2003-2007 who had the sports qualification of a candidate master of sports (CMS) and master of sports (MS).

Materials. For the research official materials of State Budgetary Health Public Establishment of Astrakhan Region "Regional medical – sports clinic" (RMSC) Astrakhan, verified diagnoses, findings of medical examinations, the results of functional tests, tests of special physical training SPT were used. Reports of the leading coaches-specialists in gymnastics of the Olympic reserve sports school named after L. A. Tikhomirova; Sidorenko A. Yu., Ivanova E.V., Kostenko O.G. **Research methods.** For statistical data processing, quantitative variables were used, represented as the average value $\pm$ standard error of the average value ($M \pm m$). The results were considered as statistically significant in terms of $p < 0,05$. The correlation analysis was performed using Pearson correlation coefficient. **Results.** The carried out research work helped to determine the characteristic features of the effective jumping exercises fulfillment in female-gymnasts, depending on the localization and character of musculoskeletal system injuries. **Conclusion.** Effective rehabilitation of sports mastery level after temporary break connected with injuries of musculoskeletal system should be organized taking into account not only the character and localization of the injury, but also the level of the whole organism regulating adaptive potential during the initial period of the training process. The difficulty of high amplitude exercises fulfillment rehabilitation is proved by the fact that during educational-training process organization coaches-specialists face not only considerable decrease of difficult coordinating and jumping elements level, but also considerable potential decrease of gymnasts' muscular-ligamentous apparatus and cardiorespiratory system.

Keywords: free callisthenics, recovery period, high-amplitude exercises.

For citation: Aleksandr V. Dorontsev*, Anastasiya A. Svetlichkina, Nina A. Zinchuk, Kseniya A. Dorontseva. Analysis of the recovery period among highly qualified women-gymnasts after lower extremities injuries. Russian Journal of Physical Education and Sport. 202; 15(2): 34-37. DOI: 10.14526/2070-4798-2020-15-2-41-46

INTRODUCTION

Modern development of free calisthenics has the diversity of competitive compositions [2,12,]. Model characteristics of competitive programs include the exercises of the highest difficulty. They demand high level of functional training from athletes [3,13]. difficult coordinating exercises fulfillment, connected with high amplitude, claims special demands on reserve indices of athletes' locomotor

apparatus [5,7,8]. One more important aspect of educational-training lessons at a sports school is recovery period for the athletes after a long-term break, connected with injuries [9]. Foreign scientists [1,10,11] prove the importance of the personified choice of educational-training process methodical support during recovery period. In the structure of lessons during recovery period it is necessary to take into account not only the character and degree

of an athlete injuries, but also comparability of physical load and real level of organism systems functional reserves [4,6,14,15,16,17]. Taking into account mentioned above facts we studied the skills of jumping exercises fulfillment recovery in female gymnasts after locomotor apparatus injuries.

The aim of the research is to define interconnection between character and localization of the injury and the skill of jumping exercises fulfillment recovery.

MATERIALS AND METHODS

The first stage of the research was obtaining the history according to the initial medical aid appeal ability in female athletes with locomotor apparatus injuries at RMSC in Astrakhan. As a result, we revealed the following diagnoses:

- big toe nail bone fracture of a jumping leg (S 92.4), patient K. year of birth 2005 MS,
- shin shaft fracture (S 82.2) – patient A. year of birth 2004 MS;
- sprain of ankle (S 93.4) - 2 patients N. year of birth 2005 and E. year of birth 2006 CMS and 1 patient L. year of birth 2004 MS.

All athletes went through the corresponding rehabilitation period and were permitted to attend educational training lessons by a doctor.

At the second stage of the research we analyzed the results of skills rehabilitation in exercises fulfillment with high amplitude and also hemodynamic indices of athletes during maximal loads and early rehabilitation.

At the final stage of the research we defined statistical validity of the studied differences of the average values (Student t-test). The research works were carried out on the basis of Astrakhan State Medical University and sports school of the Olympic reserve named after L.A. Tikhomirova in 2018 – 2019, Russia.

RESULTS AND DISCUSSION

During the research we analyzed the periods of athletes' adaptation to physical load and effectiveness of amplitude exercises fulfillment. During the work we revealed that in case of lower extremities injuries athletes started to train again after the break of 4-8 weeks, in case of shin fracture

the female gymnast started to train after 18 weeks of rehabilitation. In the practice of amplitude exercises (jumps) rehabilitation in case of big toe nail bone fracture of a jumping leg there was considerable results decrease in all jumping elements according to the scale of difficulty from 0,6 till 0 points in a jump into a split with a turn, in a jump into a split with a turn with legs change from 0,6 till 0 points, turning jump into a split from 0,5 till 0,3 points, fouetté – a jump into a split from 0,5 till 0,3 points, fouetté – turning jump from 0,4 till 0,2 points, "Revoltade" from 0,3 till 0 points. At the same time, it is necessary to underline that the first 4 weeks the athlete fulfilled jumping elements in orthopedic sneakers because the doctor gave such recommendations. Confident jumps fulfillment according to "Difficulty" scale till 0,5 points was finished 6 weeks later ($p < 0,044$), till 0,6 points 8 weeks later ($p < 0,047$). Special difficulty in mastering caused the types of jumps with landing on a take-off leg, as a pain syndrome in case of dynamic load occasionally appeared more than 8 weeks.

A typical injury of swing-up leg in 3 gymnasts was ankle injury in a form of capsular ligamentous apparatus of ankle sprain. Rehabilitation period was 3 - 4 weeks, educational-training lessons were held in braces. They help to decrease the risk of repeated injury of ankle joint because of its incomplete stability in case of dynamic load.

In accordance with the held research it was revealed that all athletes had the dynamics and cadence of step decrease during the preparatory phase of the jump in a run and it decreased the effectiveness of jumping exercises. During the initial phase of adaptive period of lessons all gymnasts had the results decrease in jumping elements fulfillment according to "Difficulty" scale for 0,3 points in jumps with maximal mark 0,6 points and for 0,2 points in amplitude exercises with maximal value of the element 0,4 points.

Considerable renewal of jumping exercises indices was defined during 5-6 weeks after the trainings beginning. Complete recovery of stable results of jumping elements fulfillment was in the final phase of adaptive period 7-8 weeks ($p < 0,044$). In our opinion, compensatory reserves of muscular-ligamentous apparatus of a swing-up

leg and a permanent pain syndrome in case of high intensity dynamic load were the first reasons for amplitude exercises effectiveness decrease and the coaches should pay attention to this fact during the adaptive period. Instrumental medical check-up of hemodynamic characteristics in gymnasts with a big toe nail bone fracture and ankle injury during adaptive period didn't reveal the risks of pathological changes in cardiovascular system development.

Special attention during the research was paid to the gymnast with shin shaft fracture of swing-up leg, taking into account the character of injury recovery period was 18 weeks. The difficulty of rehabilitation period was in considerable decrease of general physical readiness level, weight gaining more than 5 kg., functional reserves decrease of cardio-respiratory system. The gymnast had sinus tachyarrhythmia. It is the index of not trained cardiovascular system, vital capacity (VC) also decreased by $21,7 \pm 3,2\%$, functional test at a bicycle ergometer with the load 70 W was stopped during the 3rd minute in terms of submaximal HR values. General adaptive period of the athlete was 12 weeks. At the same time it is necessary to mention that the indices increase of jumping elements fulfillment had a high correlation with the gymnast's weight normalization; weight at the initial stage of lessons $P - 50 \pm 1,0$ kg. in 4 weeks $47,4 \pm 1,0$ kg., at the final stage of the adaptive cycle $44,3 \pm 1,0$ kg. ($p < 0,048$; $r - 0,619$). The most difficult phase during the adaptive period can be considered the second 4 weeks, when there was plateau in weight decrease and the intensity of difficult coordinating exercises increase caused reaction of cardiovascular system in a form of HR outcome $\geq 180 \pm 7,2$ beats/min from the training zone. It increased the risk of disadaptive reaction of an organism development to physical load. The final phase of adaptive period was characterized by confident skills renewal of amplitude exercises technique fulfillment according to "Difficulties" scale with the highest point 0.4 points, from $0,1 \pm 0,1$ till $0,3 \pm 0,1$ points ($p < 0,039$), jumps fulfillment with maximal mark 0.6 points was recovered from 0 till $0,5 \pm 0,1$ points ($p < 0,048$).

At the same time the received results of competitive program running were characterized by insufficient stability of connectives fulfillment,

demanding high coordination of movements. Functional test fulfillment at bicycle ergometer during the 12th week of lessons, within 5 minutes with the help of 70 W load showed that a satisfactory result HR $157 \pm 7,3$ beats/min ($p < 0,031$), VC was $19,7 \pm 2,5\%$ ($p < 0,039$). Electrocardiographic examination held at the end of the recovery period didn't reveal pathological changes of cardiovascular system metabolic character.

CONCLUSION

Practical importance of the held research results is in the stages determination of rehabilitation educational-training lessons in highly qualified gymnasts and in the volume of amplitude exercises planning substantiation in the structure of the training lessons. The effectiveness of jumping elements fulfillment recovery mainly depends on the difficulty and localization of locomotor apparatus injuries, on reserve potential of muscular-ligamentous apparatus, cardiovascular and respiratory systems. The difficulty of recovery programs methodical support formation after the break, connected with locomotor apparatus injuries, was posttraumatic pain syndrome. It appeared in terms of high dynamic loads.

Thus, the received results prove that different in character and localization traumatic injuries of lower extremities in gymnasts demand individual algorithms creation of educational-training lessons structure during recovery period, taking into account sports qualification.

REFERENCES

1. Armstrong N., Welsman J.R. The physical activity patterns of European youth with reference to methods of assessment. *Sports Medicine*. 2006; 36: 1067-1086.
2. Belokopytova Zh.A., Lavrenteva V.A., Kozhevnikova L.K. Effectiveness of the created program of coordinating abilities development among 10-13 year-old girls, who go in for calisthenics. *Nauchno-teoreticheskij zhurnal Fizicheskoe vospitanie studentov*. 2011; 3:12-16 [In Russ.].
3. Viner I. A. Gymnasts' artistry level at the stage of initial and specialized training. *Uchenye zapiski universiteta imeni P.F.Lesgafta*. 2012; 3 (85): 97 [In Russ.].
4. Grechukhin I.V., Goncharova L.A. Complex studying of injuries using the principles

of chronobiological analysis and prediction. *Astrahanskij medicinskij zhurnal*. 2011; 2: 14-17 [In Russ.].

5. Dorontsev A.V., Gorst V.R., Medvedev A.S. Risk factors of neurological pathologies development in structural elements of spine among people, who go in for power kinds of sports. *Uchenye zapiski universiteta imeni P.F.Lesgafta*. 2017; 8(150): 25-29 [In Russ.].

6. Ermolina N.V., Morozova O.V., Dorontsev A.V., Lyamina Yu.A. Physical readiness analysis among schoolchildren according to the results of "Presidential competitions" during 2015-2016 and 2016 – 2017. *European Social Science Journal*. 2018; 2-1: 152-161.

7. Zaytsev B.N., Tukhvotullin R.M., Kozlova A.E. Kinds, localizations and mechanisms and reasons for sports injuries among young female gymnasts. *Uchenye zapiski universiteta imeni P.F.Lesgafta*. 2016; 4: 80-83.

8. Kasatkina N.A., Mingalisheva I.A., Kodolova F.M. The peculiarities of stability of performances formation in sports aerobics. *Pedagogiko-psihologicheskie I mediko-biologicheskie problemy fizicheskoy kul'tury I sporta = Pedagogico-psychological and medico-biological problems of physical culture and sport*. 2017; 12(3): 46-53 [In Russ., In Engl.].

9. Kozlov R.A., Andreeva O.V., Kotlyar N.N., Goltsov A.S. Sport as a factor of physical rehabilitation and social adaptation of hearing-impaired people. *Global Science and Innovation*. 2015: 304-308.

10. Magda SH Afifi. The Role of Quercetin on some Cardio-Vascular Parameters in Rats with

Insulin Resistance Syndrome. *Research Journal of Pharmaceutical, Biological and Chemical Sciences*. 2017; 8(5): 460-469.

11. Panikhina A.V., Kolesnikova O.B. Effects of recreational aerobics on adaptation of female first-year students from urban area and rural area to conditions of higher school education. *Bulletin of Experimental Biology and Medicine*. 2012; 152(4): 480-482.

12. Svetlichkina A.A., Dorontsev A.V. Differential diagnostic criteria of cardiovascular system among people, who go in for calisthenics. *Uchenye zapiski universiteta imeni P.F.Lesgafta*. 2017; 1(143): 181-184.

13. Somkin A.A., Manko L.G. Sports – Pedagogical testing the training level of 10-12 year-old female gymnasts. *Adaptivnaya fizicheskaya kul'tura*. 2014; 3(59): 34-38 [In Russ.].

14. Chichkova M.A., Svetlichkina A.A. Patent 2672934 RF. The way of complex estimation of cardiovascular system indices among disabled people URL: https://yandex.ru/patents/doc/RU2672934C1_20181121.

15. Chichkova M.A., Svetlichkina A.A. Patent 2652968 RF. The way of complex estimation of cardiovascular system indices among athletes URL: https://yandex.ru/patents/doc/RU2652968C1_20180503.

16. Schache A.G., Wrigley T.V., Baker R., Pandy M.G. Biomechanical response to hamstring muscle injury. *Gait and Posture*. 2009; 29: 332-338

17. Weerapong P., Hume P.A., Kolt G.S. Preventative strategies for exercise-induced muscle damage. *Critical Reviews in Physical and Rehabilitation Medicine*. 2004; 16: 133-149.

Submitted: 20.05.2020

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