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ORIGINAL ARTICLE

Exercise system based on mechanotherapy to prevent conditions of the osteomioarticular system in stomatologists

Sistema de ejercicios basados en mecanoterapia para prevenir afecciones del sistema osteomioarticular en estomatólogos

Sistema de exercícios baseado em mecanoterapia para prevenção de afecções do sistema osteomioarticular em estomatologistas

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ABSTRACT

Introduction: the prevention of conditions of the osteomioarticular system in stomatologists is a topic that requires an analysis from rehabilitation, especially with mechanotherapy. **Objective:** to propose a system of exercises based on mechanotherapy to prevent conditions of the osteomioarticular system in stomatologists. **Method:** a study was carried out that constituted development research in Santiago de Cuba during the period from September to December 2023. An exercise system based on mechanotherapy was developed that consisted of three stages, for the Deslizador Vago® device, with the use of the systemic-structural method (for the establishment of structural and functional relationships between the components of the exercise system). **Results:** the exercise system was aimed at the rehabilitation of eight areas according to location. It had three common actions for all of them, aimed at breathing, warming up and stretching. The exercises were basically aimed at achieving greater mobility and to develop muscle strength and endurance of selected anatomical parts, in order to prevent injuries. **Conclusions:** the proposed system constitutes an alternative to prevent conditions of the osteomioarticular system in stomatologists, based on the training and strengthening of the muscles of the anatomical structures mostly subjected to great efforts during stomatological care.

Keywords: rehabilitation; osteomioarticular system; prevention; occupational disease

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RESUMEN

Introducción: la prevención de las afecciones del sistema osteomioarticular en estomatólogos constituye un tema que requiere un análisis desde la rehabilitación, especialmente, con mecanoterapia. **Objetivo:** proponer un sistema de ejercicios basados en mecanoterapia para prevenir afecciones del sistema osteomioarticular en estomatólogos. **Método:** se realizó un estudio que constituyó una investigación de desarrollo en Santiago de Cuba durante el periodo de septiembre a diciembre de 2023. Se elaboró un sistema de ejercicios basados en mecanoterapia que constó con tres etapas, para el aparato Deslizador Vago®, con el empleo del método sistémico-estructural (para el establecimiento de relaciones estructurales y funcionales entre los componentes del sistema de ejercicios). **Resultados:** el sistema de ejercicios estuvo dirigido a la rehabilitación de ocho áreas según la localización. Contó con tres acciones comunes para todas ellas, dirigidas a la respiración calentamiento y estiramiento. Los ejercicios se encontraron básicamente dirigidos a lograr una mayor movilidad y para desarrollar la fuerza muscular y la resistencia de las partes anatómicas seleccionadas, a fin de prevenir las lesiones. **Conclusiones:** el sistema propuesto constituye una alternativa para prevenir afecciones del sistema osteomioarticular en estomatólogos, sustentado en el entrenamiento y fortalecimiento de la musculatura de las estructuras anatómicas mayormente sometidas a grandes esfuerzos durante la atención estomatológica.

Palabras clave: rehabilitación; sistema osteomioarticular; prevención; enfermedad ocupacional

RESUMO

Introdução: a prevenção de afecções do sistema osteomioarticular em estomatologistas é um tema que requer análise desde a reabilitação, principalmente com a mecanoterapia. **Objetivo:** propor um sistema de exercícios baseado na mecanoterapia para prevenção de afecções do sistema osteomioarticular em estomatologistas. **Método:** foi realizado um estudo que constituiu pesquisa de desenvolvimento em Santiago de Cuba durante o período de setembro a dezembro de 2023. Foi desenvolvido um sistema de exercícios baseado em mecanoterapia que consistiu em três etapas, para o aparelho Deslizador Vago®, com a utilização do método sistêmico-estrutural (para estabelecer relações estruturais e funcionais entre os componentes do sistema de exercícios). **Resultados:** o sistema de exercícios visou a reabilitação de oito áreas de acordo com a localização. Tinha três ações comuns a todos eles, voltadas à respiração, ao aquecimento e ao alongamento. Os exercícios visavam basicamente alcançar maior mobilidade e desenvolver força e resistência muscular de partes anatômicas selecionadas, a fim de prevenir lesões. **Conclusões:** o sistema proposto constitui uma alternativa para prevenir afecções do sistema osteomioarticular em estomatologistas, baseado no treinamento e fortalecimento da musculatura das estruturas anatômicas mais submetidas a grandes esforços durante o atendimento estomatológico.

Palavras-chave: reabilitação; sistema osteomioarticular; prevenção; doença ocupacional

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INTRODUCTION

Stomatologists are a group particularly prone to suffer from injuries and diseases caused by the performance of their profession.[1] Some authors[1,2,3] state that they are exposed to general risks (risk patterns that alter the so-called occupational health) and risks specific to the activity (determined by the exercise and use of the profession).

It is true that these conditions have a slow onset and the sufferer is generally unaware of them until they become chronic and cause permanent damage.[3] Among these conditions, those involving the osteomioarticular system (SOMA) and especially those of the upper limbs and spine stand out,[2,3] due to the fact that the stomatologist works with his hands and in complex positions.

In this context, the most frequent affections have been described by several researchers,[4,5,6] however, not enough work has been done to prevent them. The possibilities offered by rehabilitation, including occupational therapy and mechanotherapy, to prevent their occurrence are not emphasized in the stomatological field.

Rehabilitation includes occupational therapy, in which people are helped throughout their lives to participate in the activities and tasks they require and need to perform through the therapeutic use of daily activities such as their occupations.[7] Mechanotherapy is said to be the therapeutic and hygienic use of mechanical devices designed to provoke and direct body movements regulated in their strength, trajectory and amplitude.[8]

The aim of rehabilitation is to enable the patient to perform exercises with a curative purpose. However, new approaches are now required in which individuals are trained and strengthened to prevent disorders during daily work.

It is true that mechanotherapy has a rich history that has undergone a remarkable transformation over time. From its beginnings, it has been characterised by the creation and refinement of a variety of mechanical devices designed to facilitate the recovery of patients with SOMA conditions.[9,10]

Recently, and with the advance of science and technology, sophisticated rehabilitation devices have been built that include various digitalized exercise systems, among which robotics stands out.[11,12] Although this represents a significant advance in this field, this technology is costly, making it difficult to generalize it in the different rehabilitation scenarios.

For this reason, in 2009 a device was developed: the Vago® Slider, registered by the main author under patent number 23409, whose resolution is 1757-2009. It has a multifunctional character, as it includes the function of several devices used for rehabilitation, it is low cost, easy to use by patients and rehabilitators and adaptable to any space, which is why it was selected for this research.

For all of the above reasons, the need arises to study this subject in depth and expand the use of an apparatus designed in the local context, with the aim of proposing a system of exercises based on mechanotherapy to prevent SOMA affections in stomatologists.

METHOD

A study was carried out in Santiago de Cuba during the period from September to December 2023 which, according to the possibilities of application of the results, constituted a developmental research.

The elaboration of the system of exercises based on mechanotherapy to prevent SOMA affections in stomatologists consisted of three stages:

- First stage: search and review of literature addressing issues related to SOMA conditions as occupational diseases of stomatologists.
- Second stage: detailed analysis of the different exercises to be performed in the most frequent SOMA affections in this population group; as well as the possibilities to be performed with the Vagus Slider® as a multifunctional rehabilitating device.
- Third stage: elaboration of the system of exercises according to the location of the SOMA affection.

The brainstorming method was applied, based on the results of the stages described above. Phases 1 to 7 proposed by Hernández Sampieri[13] for the construction of an instrument were followed.

- Phase 1: fundamental redefinitions.
- Phase 2: focused literature review.
- Phase 3: identification of the domain of variables to be measured and their indicators.
- Phase 4: making key decisions.
- Phase 5: construction of the proposal.
- Phase 6: pilot test.
- Phase 7: elaboration of the final version of the instrument and its application and interpretation procedure.

The dialectical-materialist method was assumed as the universal research method; as well as, in particular, theoretical methods such as the analytical-synthetic (in the selection of the exercises by location of the SOMA condition) and the systemic-structural (for the establishment of structural and functional relationships between the components of the exercise system).

From the ethical point of view, this article is part of one of the research tasks of a project registered at the Medical Sciences University of Las Tunas in alliance with the Stomatology Faculty of Santiago de Cuba; therefore, it was approved by the Ethics Committee of such health research, guaranteeing the reliability of the information.

RESULTS

The search and review of the literature on SOMA conditions as occupational diseases of stomatologists showed that those located in the spine and upper extremities are the most frequent, so the system of exercises aimed at the rehabilitation of eight areas according to location was developed (Figure 1).

It included three common actions for all areas (locations), aimed at breathing, warming up and stretching. The exercises that make up the system are basically aimed at achieving greater mobility, developing muscle strength and endurance of the selected anatomical parts, in order to prevent injuries.

Fig. 1. Preventive exercise system for occupational conditions, using the Vague Slider for stomatologists

DISCUSSION

The proposed system of exercises has been constructed using the functional structural systemic method due to the scientific-methodological need to sequence them according to areas, moments and actions in an integrated manner, in order to prevent SOMA disorders in stomatologists through rehabilitation, with the use of the Vago Slider®. In this way, interrelated exercises are constituted where hierarchical and subordinate relationships are established.

On the other hand, the system maintains a dialectic relationship that is established between the whole as a totalizing, integrated and sequenced system and the moments that are proposed (initial preparation, intermediate work and final stretching), with their specific exercises for each of the areas, as parts of that whole where the system itself acquires meaning from the parts and the parts acquire meaning from the whole.

This is based on the fact that the body functions as a biokinetic unit,[14] each exercise influences the reaction of the whole organism, therefore a system of exercises is proposed that have relationships between them and provide a comprehensive approach to rehabilitation therapy.

It is true that although exercise systems have been proposed previously,[15] they have been for conventional rehabilitation devices, among which the stairs, the trellis, digital stairs, parallels, the shoulder wheel, the ABC board and the prone supinator stand out. All of them are aimed at the rehabilitation of conditions with specific localization, which have been shown to be effective separately.

However, the Vago® Slider allows the same movements, but also has mechanisms to graduate the physical load, so that the patient can perform movements of flexion, extension, adduction, abduction, inversion and eversion in all with regulation and dosage. In addition, its multifunctionality integrates several movements in a single device, which optimizes time, human and material resources.

The proposed system of exercises strengthens the muscles and ligaments of the upper limbs to prevent injuries during the different procedures, with emphasis on the stabilizing muscles of the neck and shoulders (middle and lower trapezius muscles, responsible for shoulder stability).

The elbow is also an essential joint for stomatological work, therefore, exercises are suggested for this important structure whose affections are accompanied by loss of strength in the forearm, local pain in the area and even referred to the wrist, as well as possible paresthesia due to nerve entrapment and loss of function in the joint.

Another objective of the exercise system proposed for this team is to strengthen the muscles of the hand, wrist and elbow which are subjected to constant and excessive movements in extension and flexion. Some authors state that the greater presence of tendinitis is due to the fact that the tendons work permanently in the movement of the body and, therefore, the demand on them is in direct relation to the magnitude of the physical activity that is carried out.

It is important to emphasize that, although what is proposed in this article favors the prevention of affections, it is essential to take into account other aspects such as the appropriate positioning of the patient and the posture of the operator according to the preceding to be carried out. In addition, it is important to value rehabilitation as a tool for prevention, which is one of the functions of Public Health, to be applied by health personnel in the communities and work environment, as proposed in this article.

The health of the stomatologist requires special attention due to the fact that he or she works in special conditions, that is, in a small, dark environment such as the patient's mouth, either standing or sitting, which is why SOMA lesions are frequent. Faced with this problem, it is necessary to take into account the physical preparation of these professionals, something that can be achieved in the stomatological centers themselves by setting aside a room for this purpose.

CONCLUSIONS

The proposed system of exercises based on mechanotherapy with the Vago® Slider constitutes an alternative to prevent SOMA disorders in stomatologists, based on training and strengthening the musculature of the anatomical structures that are mostly subjected to great stress during stomatological care.

REFERENCES

1. Quinzo-Montenegro. F. Ergonomía en la práctica odontológica. Ciencia Latina [Internet]. 15 de junio de 2023 [cited 9 Mar 2024];7(3):2396-405. DOI: https://doi.org/10.37811/cl_rcm.v7i3.6355
2. Robaina-Aguirre C, León-Palenzuela IM, Sevilla-Martínez D. Epidemiología de los trastornos osteomioarticulares en el ambiente laboral. Rev Cubana Med Gen Integr [Internet]. 2000 Dic [cited 10 Mar 2024];16(6):531-539. Available in: http://scielo.sld.cu/scielo.php?script=sci_arttext&pid=S0864-21252000000600002
3. Fimbres-Salazar KL, Tinajero-González RM, Salazar-Rubial RE. Trastornos musculoesqueléticos en odontólogos. BENESSERE - RevEnferm. [Internet]. 2016 [cited 8 Ene 2020];1(1). Available in: https://revistas.uv.cl/index.php/Benessere/article/view/1337/1374
4. Coureaux-Rojas L, Navarro-Nápoles J, Limonta-Vidal E, Pérez-Fariñas N, Turcáz-Castellanos IM. Afecciones del raquis cervical y lumbar en estomatólogos de la Clínica Estomatológica Provincial Docente de Santiago de Cuba. MEDISAN [Internet]. 2013 [cited 10 Mar 2024]; 17(9):4081. Available in: https://www.redalyc.org/articulo.oa?id=368444996004
5. Pérez-Morales MD, Companioni-Landin FA, Hernández-Millán AB. Alteraciones musculo-esqueléticas originadas por malas posturas en estomatólogos. Revisión de la literatura. Actas del Congreso Internacional Estomatología 2020. La Habana, Cuba. La Habana: Universidad de Ciencias Médicas de La Habana; 2020. [cited 10 Mar 2024]. Available in: http://www.estomatologia2020.sld.cu/index.php/estomatologia/2020/rt/metadata/613/235
6. Hermoza-Gutierrez JJ, Calle-Gutierrez A, Ururi-Maye A. Análisis de factores de riesgo laboral en odontología. RevOdontBasadrina. [Internet]. 2019 [cited 10 Mar 2024]; 3(2):56-61 DOI: https://doi.org/10.33326/26644649.2019.3.2.894
7. Sainz-de-Murieta E, Cisneros MT. Rehabilitación y capacidad funcional en la salud del siglo XXI. Anales Sis San Navarra [Internet]. 2022 Dic [cited 28 Abr 2024];

45(3):e1028. DOI: https://dx.doi.org/10.23938/assn.1028

8. Rigñack-Ramírez RC, Rodríguez-Díaz JC, Ricardo-Velázquez B. Estudio sobre el empleo de la mecanoterapia y la terapia ocupacional en la rehabilitación de pacientes con enfermedad de Parkinson. RevCient Especial Ciencias Cultura Física Deporte [Internet]. 2022[cited10 Mar 2024];19(4):103–111. Available in: https://deporvida.uho.edu.cu/index.php/deporvida/article/view/880
9. Suárez-Bonilla X, Rodríguez-Pérez ME. Surgimiento de la fisioterapia en México a partir de la rehabilitación durante el siglo XX. Investigación EducMédica[Internet]. 2022 Sep [cited 28 Abr 2024]; 11(43):108-120. DOI: https://doi.org/10.22201/fm.20075057e.2022.43.22426
10. Sainz-de-Murieta E, Cisneros MT. Rehabilitación y capacidad funcional en la salud del siglo XXI. [Internet]. AnSistSanitNavar[Internet]. 2022 [cited 28 Abr 2024]; 45(3):e1028. Available in: https://doi.org/10.23938/ASSN.1028
11. Sagaro-Zamora R. Terapia robótica y estimulación eléctrica transcutánea en el tratamiento del hombro doloroso del paciente hemipléjico. RevCubMed [Internet]. 2023 [cited 28 Abr 2024]; 62(2). Available in: https://revmedicina.sld.cu/index.php/med/article/view/3125
12. Gómez-Rendón JF, Moreno-Arango JD, Medina-Salcedo JM, Becerra-Velásquez J, Gil-Henao GA, Gil-Guerrero MA. Rehabilitación robótica en espasticidad de mano y muñeca. Rev. Colomb. Med. Fis. Rehabil. [Internet]. 2021 [cited 28 Abr 2024];30(2):103-15. DOI: https://doi.org/10.28957/rcmfr.v30n2
13. Hernández-Sampieri, R, Fernández-Collado C, Baptista-Lucio P. Metodología de la investigación (6a. ed.). México D.F.: McGraw-Hill. 2014.
14. Puentes-Abundio E, Calero-Morales S, Puentes-Bencomo DB, Puentes-Bencomo ER, Chávez-Cevallos E. Las propiedades mecánicas del accionar del cuerpo humano. Su manifestación en las técnicas del aikido. Rev Cubana InvestBioméd [Internet]. 2018 Dic [cited 28 Abr 2024]; 37(4):1-14. Available in: http://scielo.sld.cu/scielo.php?script=sci_arttext&pid=S0864-03002018000400020&lng=es
15. Echemendía-del-Valle A, Sentmanat-Belisón A, Noa-Pelier BY, Gómez-Pérez R. Programa de ejercicios para las transferencias y la marcha en los pacientes lesionados medulares. RevPodium [Internet]. 2022 [cited 28 Abr 2024]; 17(3):876-891. Available in: http://scielo.sld.cu/scielo.php?script=sci_arttext&pid=S1996-24522022000300876&lng=es

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