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Dental Assistance for Children with Cerebral Palsy and Tecnological Perspectives for Rehabilitation

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The improvement of oral health and quality of life is closely related to transdisciplinary dialogue, technological development and social responsibility. In patients with cerebral palsy, the lesion of motor areas of the brain compromises the development and function of the craniofacial complex. Considering all the ethiopathogenic conditions, the treatment of such patients involves great difficulties. The dentist and other professionals related to their rehabilitation need to deal with difficulty in chewing, respiration, phonation, besides the poor oral hygiene resulted from abnormal involuntary movements of facial and masticatory musculature, tongue, and upper limb. It is also relevant the lack of understanding about the importance of oral health care due to mental deficits of these individuals. This study aims to review some aspects of oral health in patients with cerebral palsy proposing rehabilitation associated to technology. Few studies concerned about the effectiveness of therapies for oral rehabilitation in patients with cerebral palsy. Laser therapy, electromyography, electrostimulation and LED therapy should be analyzed as options for treatment of patients with cerebral palsy. Following research projects should focus more attention on the dynamic and oral function of these patients to achieve positive repercussions in their overall health.
Key-words: cerebral palsy; electric stimulation; electromyography; laser therapy; oral health; phototherapy

ARQUIVOS DE MEDICINA, 24(2):59-64

INTRODUCTION

In the contemporaneous world, the implementation of a transdisciplinary approach, technological improvement and social responsibility are indispensable for the professional who aims to promote health. Promoting health involves the dentist's choice to defend life in a pluralist and tolerant conjecture.

The oral cavity is responsible for vital physiological functions for the maintenance of overall health, since it is involved with nutrients absorption, which is essential to physical and mental development; with defense from pathogenic microorganisms due to enzyme and antibodies from saliva; and also with feeling expression. Besides, the mouth is an important structure for social life and relationship, affecting the judgment of appearance and functioning as a connection instrument between people.

In patients with cerebral palsy (CP), the involvement of motor areas of the brain determinates a delay in motor development of audio-phonological and articulatory organs (1). In these patients, the presence of reflex is frequent while patients of the same age, but without this disorder, do not present any reflex. Therefore, the pathological persistence of these reflex compromises the perfect functional efficiency of masticatory organs and development of refined muscle activities.

The increasing advancement of science permitted new technologies to be used to assist diagnosis and rehabilitation of patients that suffer from neurological damage. The interdisciplinarity has contributed to the improvement of quality of life, promoting more functional independence of people that were completely considered as dependents.

Surface electromyography has been indicated for the comprehension of the biomechanics of the jaws. The use of neuromuscular electrostimulation has proved to be very useful in the rehabilitation of patients with neurological problems. International protocols recommend high frequency sessions per week, or even twice a day (2). Another instrument used for the recuperation of nerve function, is phototherapy, which is based on its property of acceleration of healing process and tissue repair.

In this context, this study aims to review some aspects of oral health in patients with cerebral palsy, suggesting their rehabilitation in agreement with technological development.

CEREBRAL PALSY

Cerebral palsy (CP), also defined as chronic non-progressive encephalopathy of childhood, results from primary brain injury, often induced by lack of oxygenation of brain cells during the pre-, peri- or postnatal period, affecting the central nervous system in phase of structural and functional maturation (3-5). This non progressive

disturbance refers to a group of disorders related to movement and posture, causing activity limitation (6).

The motor disorders are permanent and mutable, causing secondary musculoskeletal changes and limitations of physical and mental activities (7). These disorders of motor development are often accompanied by disturbances of sensation, perception, cognition, communication and behavior, epilepsy, and secondarily, musculoskeletal problems (8). It is estimated that in the general population the prevalence is 2/1000 (9).

The sequels vary in intensity and location, depending on the cerebral area that was affected, as well as the extension of the lesion. There are not identical cases of people with cerebral palsy. In certain situations, the residual sequel is minimal, representing just few motor problems, such as mild claudication and stereotyped posture during physical effort. It must be emphasized however, that even in mild cases, the motor involvement, though minimal, affects these people psychologically, resulting in anxiety and even in the reinforcement of stereotyped posture pattern (2).

The classification of CP is based on the part of the brain that was damaged and on the pattern of movement alteration. In relation to muscle tonus, the spastic type (lesion of the motor cortex and incidence of 75%) is the most frequent, with increase of muscle tone. The extra-pyramidal is the second most common type, and is characterized by the lesion of the basal ganglia, leading to slow involuntary movements, defined as athetoid movements. The ataxic CP is infrequent and difficult to diagnose, occurring due to cerebellar lesion, and consequently, resulting in the inability to finely coordinate movements. The mixed type cerebral palsy represents the combination of two or more types of CP, usually involving spastic with athetoid (10,11). According to the affected area, CP can also be topographically classified: hemiparetic, diparetic and quadriparetic (12,13).

Cerebral palsy and oral health promotion

The most frequent general and oral complication in people with CP are pulmonary and upper airway infection, swallowing difficulties, saliva drooling, dysphagia and oral persistence of primitive reflexes (14).

In relation to the oropharyngeal dynamism, the oral phase is affected and characterized by the inability to control the food in the mouth. This can occur due to lip incompetence, loss of oral reflexes and movement of anterior and dorsal parts of the tongue (15).

Concerning the motor disorders, the postural alterations can interfere in the craniofacial development, leading to a poor performance in chewing, swallowing, breathing and phono-articulatory functions (15-17). Besides the inference in development of such functions, orofacial myofunctional disorders are also common in people with CP and thus it is important to expand the knowledge in this area for an appropriate prognosis and treatment of these abnormalities (18).

The importance of electromyography in diagnosis of masticatory disorders

The alterations in posture and movement of patients with CP manifest as various motor dysfunctions. The disequilibrium of masticatory muscles is intimately related to the disequilibrium of the postural system. The mandible movements are connected to the cervical movements and these, through compensatory postural synergies, are associated, in turn, with the rest of the body (19).

The dynamics of the mandible and related organs can be evaluated through surface electromyography, which studies the kinesiology (kinesio= movement; logy = study) of groups of striated muscles.

This is a useful diagnosis tool for dentists, physiotherapists, speech therapists, occupational therapists, neurologists, otolaryngologists, orthopedists and professionals of related areas that need objective parameters for clinical evaluation of muscular activity, as well as to evaluate the therapeutic results.

The electromyography also investigates the general muscular alterations and determinates the beginning of muscular activation and the coordination or disequilibrium of different muscles evolved in kinesiology of muscles.

In patients with temporomandibular disorders, surface electrodes are used in electromyography in order to determinate the electrical activity of position in mandible at rest and the hyper or hypoactivity of such muscles, and also to examine the equilibrium of muscles during chewing function, clenching teeth and parafunctional activity (20,21). Since orofacial disorders are common in individuals presenting CP, research in this area is fundamental for appropriate prognosis and treatment.

Though there exists a lot of factors that can influence the contraction pattern of masticatory muscles, the stability of masticatory muscles can be analyzed by means of the symmetric evaluation activity of homologous muscular activity (19, 22,23). Thus, the orofacial electromyography evaluation can provide an objective measurement of quality of movement in children with CP (18), contributing to treatment planning and oral rehabilitation.

Oral rehabilitation in cerebral palsy

The dental management of patients with CP, considered their ethiopatogenic conditions, evolves great difficulties, since the dentist faces impasses that result in poor oral hygiene, due to the abnormal involuntary movements of facial and masticatory musculature, tongue, and also upper limb.

These extrinsic factors interfere in teeth brushing, resulting in the accumulation of bacterial plaque (24). It must be also considered the difficulties in understanding of the importance of oral health due to the patients` mental impairment.

A high prevalence of not treated oral diseases is characteristic in children and adults with CP (25-27) presenting malocclusion, anterior open bite, increase of superior, narrow and high palate, oral breathing pattern, bruxism and presence of residual food, conditioned by the aggravating factor of muscular dysfunction (27-29).

Few studies concerning the quality of oral movements and the rehabilitation in individuals who have CP are found in literature.

According to antique concepts, when the incapacity of neuronal division was accepted, an efficient functional recuperation was impossible, justifying the inertia of the treatment, which was based on nature or time for the spontaneous recuperation of damaged functions. The discovery of neuronal plasticity ended with this therapeutic passivity, resulting in the study and origin of innumerable protocols of rehabilitation, based on chemical and electrical transmissions. Thus, several therapeutic procedures can result from the same neurotransmission (30).

The surface neuromuscular electrostimulation is based on the application of a controlled electric current externTeh in the skin surface, through specific electrodes, aiming to reach a muscle or group of muscles and / or their nerve terminals, producing a muscular contraction (2). Advices that produce electrical pluses excites the peripheral nerves and, subsequently, muscular tissue. The electric pulses penetrate the corporal tissues through the surface electrodes. Nowadays, a lot of different types of electric stimulators are available in the market. The main difference between them is the electrical output, that can determinate a constant current or a constant tension (31).

Research on animals and human beings confirm that the modification of skeletal muscles properties by means of the prolonged electric stimulation is possible. The functional and structures alterations correlate to the molecular changes, confirming the muscular plasticity.

The Nobel Price of 1986 contemplated a discover made in part in Brazil from the laboratory of Institute of Biophysics from Universidade Federal do Rio de Janeiro. The Italian scientist Rita Levy-Montalcini showed the existence of the Nerve Grown Factor- NGF, a fluid produced by the own organism that, in contact to the nervous cells, has the property of making them grow. By using resources of Genetic Engineer to produce the NGF, a promissory field started for treatment of series of degenerative diseases of nervous system and thus, with applicability for CP. According to the researcher, in animals, the NGF is capable of regenerating nervous cells, but they still need concrete evidences that it also happens in human beings. According to Aloe (32), this discover was one of the most notable for neurobiology development in the last 60 years.

One of the effects of the using prolonged electrostimulation are changes in muscular function, as well as improvement in overall condition of surrounding soft tissue (33). Kerr et al. (34), in his review article, described two theories about strengthening mechanisms: first, the muscle would strengthen by the principle of overcharge, which would increase the cross-sectional area of the muscle; the second would be by the selective recruitment of type II fibers (fast-twitch fibers, relatively larger in diameter), causing an increase of synaptic efficiency in the muscle. Jensen & Sinkjær (35) evaluated the effects of electrostimulation in the afferent innervation of anesthetized rats and observed that the sensorial information stands preserved in the afferent enervation of muscles submitted to electrostimulation.

Kraft apud Lianza (36) compared groups of acute and chronic hemiplegic patients submitted to electrostimulation. The chronically hemiplegic individuals reached and maintained functional improvement. It was demonstrated that functional electrostimulation in chronic hemiplegic superior members was efficient in reconditioning of motor activity associated to perception, favoring voluntary movement, adjusting muscular tonus and reducing abnormal postural and motor patterns.

It should be worthwhile, then, to adequate this methodology for patients with CP aiming to improve their masticatory performance.

Nunes et al (2) evaluated the effects of neuro-muscular electrical stimulation in strength, movement amplitude and gross motor function of the toe, during walking, running and jumping in spastic hemiparetic children. It was demonstrated that it was efficient in all groups and suggested that it is useful even in low frequencies, such as once a week.

This reinforces that the neuro-muscular electrical stimulation is therapeutically useful for the reestablishment of stomatognathic system in children with CP.

The laser irradiation has also been used as surgical and biomodulator agent for therapy both in medical and dentistry specialties (37).

Clinical and experimental studies evidence the property of the laser to increase nerve function (38), prevent scar formation (39), accelerate the metabolism of neurons and also the capacity of myelin production. Since the laser photodynamic therapy is not invasive, it presents the advantage of radiating damaged nerves without surgical interventions.

Low-level laser therapy is effective for treatment of orofacial pain, since it presents analgesic effect, reducing pain from diverse etiologies, including trigger points in myofascial pain (40,41). Besides, it has anti-inflammatory properties that reduce edema and hyperemia, presents antibacterial action and biostimulator effect on cellular tropism, accelerating the process of tissue repair (42,43).

The effectiveness of low-level laser in dentistry has been demonstrated in several studies, showing rapid recovery and pain relief in cases of recurrent aphthous stomatitis, traumatic ulcers, herpetic lesions, pericoronitis, gingivitis, primary herpetic gingivostomatitis, recurrent herpes simplex, dentin hypersensitivity, angular cheilitis, periodontitis / periocementitis, burning mouth syndrome, alveolitis, temporomandibular disorder and mucositis (44-47).

Another photoactivated instrument for rehabilitation is LED (light-emitting diode), a semiconductor device composed by several layers of semiconductors that emit light when a tension is applied between the layers. It is indicated for diverse purposes such as low intensity radiation therapy, CD and DVD players, barcode readers, among others.

In the later 90´s, Shuji Nakamura developed the blue LED, composed by gallium nitrate. This LED, which is narrowband light (higher selectivity than common light),

present minimal heat release, is cheaper and economic, in relation to the electrical energy consumption (43).

Whelan et al (48) reported that LED is a secure, efficient, easy to carry and less expensive option for wound healing. It presents a lot of advantages when compared to laser for clinical use. Differently from the laser, the LED allows the treatment three-dimensionally and of a wider surface. Besides, the dissipation of heat is low, not offering risk to tissue and then been accepted for application in human beings.

In 2003, Vinck et al (49) investigated the increasing of the fibroblastic proliferation induced by both LED and laser irradiation. The authors concluded that both stimulated proliferation in vitro and suggested that with adequate parameters they could possibly present bio stimulatory effects for healing in vivo.

DISCUSSION

The current and constant transformations undergone by the area of health in relation to diagnosis and rehabilitation resulted in the modern concept of expanded health, which integrates the environment, social and psychological factors. This represents a great advance, since until the 80s of the twentieth century the focus was, above all, the disease (50).

According to the World Health Organization (2001)[1], 10% of the world's population consists of individuals with special needs, 50% of them presenting mental retardation, 20% physical disabilities, 15% hearing impairment, 5% visual impairment and 10% multiple alterations. Most of these individuals live in underdeveloped countries or developing countries and only 2% receive appropriate treatment according to their needs.

Appropriate care should mean access to treatment of dysphagia, upper and lower airway dysfunction, xerostomy, oral breathing pattern, bruxism and gastroesophageal reflux which are the most frequent alterations, that interfere directly or indirectly, in a greater or lesser extent, in form, function and esthetics of stomatognathic system.

These abnormalities represent risk for both oral and overall health of these people, who are also venerable because of their low socioeconomic level, dependence on the quality of care offered by another person and the limitation of public and private specialized health services (15-17).

Though the oral diseases that affects people with CP do not differ from that suffered from the general population (tooth decay, periodontal disease, malocclusion, bruxism, masticatory disorders and enamel hypoplasia), they often occur more frequently in patients with CP due to poor oral hygiene, food type and consistency, use of medication, facial muscle tonus, lack information and access to dental services (24,51-55).

The rehabilitation of these patients means dealing with all physiological, anatomical and environmental restrictions, in order to improve their independence, and as a consequence, the quality of life of their entire family (56).

Under the perspective of holistic oral health, the rehabilitation of the stomatognahtic system must not only improve the masticatory function, but also stimulate the comprehension that the mouth performs delicate physiological and vital functions that reflects in overall health.

Considering all the physiological, behavioral and social impacts that can be achieved by means of adequate and modern treatment, knowledge in this area is essential to improve prognosis and treatment of people with cerebral palsy.

Though some literature reviews focused on the improvement of dynamics of the stomatognathic system of patients with special needs, it still cannot be found studies or reviews concerning neuromuscular electrostimulation associated or not to laser or LED therapy in their rehabilitation.

The present review presents some effective alternatives of treatment and shows that this research area is a promissory field for the improvement of quality of life of people with special needs.

Among the methods of treatment for the recuperation of neuromuscular function, electrical stimulation is used with the objective of minimizing nerve degeneration and muscle weakness during the period of regeneration (57-58).

Though the molecular basis is still unclear, phototherapy with low-level laser is another instrument for its property of increasing nerve regeneration (59). When Karu (60) irradiated isolated mitochondria, it was observed that the laser irradiation induced positive changes on the cellular homeostasis. This suggested that some components of the respiratory chain (cytochromes, flavins and dhydrogenase) are capable of absorbing light and that results in the increase of ATP synthesis, affecting the levels of cellular hydrogen and activating ionic gradient (sodium, potassium and calcium).

CONCLUSIONS

This review evidences the role of phototherapy in the promotion of recovery of muscle morphophysiology, in the reduction of inflammatory responses and in pain relief, as well as the role of electrostimulation in the modulation of hypo or hyper stimulation of muscle fibers, adjusting them to normal physiological pattern of contraction and relaxation.

Biomedical engineering represents a promissory field for development of neural stimuli applicable to home healthcare, after establishment of protocols and professional training. Scientific research may provide bioelectronic sensors that can capture brain waves emitting electrical stimuli to the masticatory muscles for rehabilitation of people with cerebral palsy.

This study confirms the importance of oral rehabilitation in patients with cerebral palsy and its impact on overall

[1]*Available in URL: http://www.who.int/whr/*

health and therefore, on their quality of life.

Agradecimentos
Os autores agradecem a Coordenação de Aperfeiçoamento de Pessoal de Nível Superior(CAPES) pelo apoio no desenvolvimento desta linha de pesquisa.

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