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INSPIRATORY MUSCLE TRAINING IN PATIENTS WITH COVID-19: EVALUATION OF CLINICAL PRACTICE

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ABSTRACT

The disease caused by SARS VOC 2, called COVID 19, is an infectious disease of the respiratory tract and may vary from mild symptoms to conditions severe, requiring hospitalization hospital with significant mortality rate Physical therapy has the aim of limiting the after-effects of the virus and hospital stay, promoting functional recovery and optimization high hospital. The Training Inspiratory Muscle (TMI) is a technique physiotherapy c om order to strengthen and optimize the respiratory muscle strength and endurance through devices with resistive loads. The objective of this research is to evaluate the applicability of Inspiratory Muscle Training in the treatment of COVID-19. This is a cross-sectional descriptive study , with a quantitative approach to the data . The professionals were submitted to an online sociodemographic and clinical questionnaire regarding the use of IMT in patients with COVID-19. The results showed that 64.7% of physical therapists frequently use IMT as a treatment strategy for COVID-19 and 58.8% of respondents stated that IMT improves the patient's functional capacity. It is suggested that the use of IMT in critically ill patients with COVID-19 is a resource capable of improving functional capacity, increasing inspiratory muscle strength and endurance and improving the patient's quality of life.

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INTRODUCTION

Infection by the Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) generates a multisystemic infectious disease (COVID 19) that predominantly compromises the respiratory tract, ranging from mild symptoms to severe conditions, need for hospitalization, mechanical ventilation and significant mortality rate (FALAVIGNA *et al*., 2020). The first case of the disease was identified in the city of Wuhan, province of China, in December 2019. Currently, more than 20,000,000 confirmed cases and 852,000 deaths have been reported worldwide (World Health Organization - WHO, 2020). Until the last update of the State Health Secretariats, on September 1, 2020, there are approximately 3,900,000 cases confirmed by epidemiological notification and more than 122,000 deaths confirmed by COVID-19 in Brazil (MINISTÉRIO DA SAÚDE, 2020).

The transmission of the virus occurs through the respiratory tract, through droplets, respiratory secretions and direct contact with infected patients, with an incubation period of 14 days. COVID-19 can affect all age groups, but it can become more severe in the elderly, children and pregnant women, in addition to people who have chronic conditions such as diabetes, cardiovascular disorders, obesity and respiratory disorders (GUO *et al*., 2020). According to studies by Lai (2020), the main clinical manifestations are fever, dyspnoea and cough, while other symptoms include myalgia, headache, diarrhea and upper airway congestion. According to Guimarães (2020), about 80% of infected people do not need hospitalization, while 15% require hospitalization in the intensive care unit (ICU). This rate is evidenced by the high demand for beds, equipment and health professionals in the ICUs. The period of hospitalization in the Intensive Care Unit (ICU) has serious consequences, especially in critically ill patients.

The most common is the weakness acquired in the ICU, related to immobility, sub-ideal glycemic control and iatrogenesis due to the use of steroids and neuromuscular blockers, in addition to polyneuropathy, myopathy in the critical patient and cardiorespiratory deconditioning. Although there is no prior knowledge about the long-term physical consequences of COVID-19, patients who require mechanical ventilation in the most acute stage of the disease may have a clinical condition called post-intensive care syndrome, characterized by prolonged disability, muscle dysfunction, fatigue, pain and dyspnoea (SILVA; SOUSA, 2020). Through all the clinical manifestations of the disease and the prolonged hospital stay, it is necessary to develop a treatment plan in order to alleviate and / or remedy the complications of COVID-19. For this, it is essential to carry out tests and exams that clarify the individual's cardiopulmonary level and provide data for the application of the best physiotherapeutic technique. Manovacuometry is a simple, non-invasive and effort-dependent test, which consists of measuring the force generated by the breathing muscles, that is, the maximum respiratory pressures, being the Maximum Inspiratory Pressure (MIP) for the inspiratory muscles and the Maximum Expiratory Pressure (MEP) for expiratory muscles and for assessing the quality of cough. The test is performed with forced breaths of MIP and MEP by occluded airway. The test result is directly related to lung elasticity and respiratory muscle capacity. The interpretation of the data may identify clinical changes as possible indicators of neuromuscular diseases, treatment planning for pulmonary rehabilitation, weaning from mechanical ventilation and as an assessment tool after interventions (SANTOS *et al*., 2017).

Among the health areas that are at the forefront of the fight against COVID-19, physiotherapy is present with the objective of limiting the sequelae of the virus and the period of hospitalization, acting early in the initial phase of the disease, in the acute phase and in after hospitalization, promoting functional recovery and consequent optimization of the discharge process. In the most acute phase of the disease, the disturbance in the ventilation-perfusion system can lead to several serious clinical conditions, such as hypoxemia (GUIMARÃES, 2020). Pedrosa (2006), approaches that the Inspiratory Muscle Training is a technique of respiratory physiotherapy that aims to strengthen and optimize the strength and endurance of the respiratory muscles, through devices with resistive loads generating maintenance and / or increase of the maximum inspiratory force (MIP). For this reason, the present study aims to assess the applicability of Inspiratory Muscle Training in the treatment of COVID-19, with analysis of clinical practice.

MATERIALS AND METHODS

This is a descriptive study, with a quantitative approach to the data and a cross-sectional design, with the objective of evaluating the applicability of Inspiratory Muscle Training in the treatment of COVI D -19. The study was carried out in a private Hospital Institution with SUS accreditation, located in the city of Vitória da Conquista, Bahia. The study population was composed of physical therapists with physical therapy in hospital training which are linked to the place of study. The inclusion criteria for the study were physiotherapists working in the hospital environment who have worked for at least 10 hours a week for at least 30 days, in a sector designed to care for patients with COVID-19, while the inclusion criteria were non-acting physiotherapists. in the hospital environment. The instruments used for data collection were a semi-structured sociodemographic and clinical online questionnaire, produced by the researchers with 24 questions and the Informed Consent Term, both made using the Google Forms platform. The questionnaire was divided into two main blocks, the first covers personal training professional co ntendo question are of the type: a) time academic training; b) higher degree; c) hospital location, and the second block covers the use of the technique studied in the treatment of COVID-19 , such as: a) Inspiratory Muscle Training, in its objective clinical practice ? b) What training method do you use for Inspiratory Muscle Training? . The ques the only was available for viewing after the reading and accepting of IC.

The study was carried out after approval by the Ethics and Research Committee of Faculdade Independente do Nordeste (FAINOR). Initially was held contact with the physiotherapy service coordinator of the field of study in order to disseminate the study, and after approval was requested to contact the physiotherapists who met the inclusion criteria. Then, contact was made with the research participants through the WhatsApp messaging application, informing them about the details of the study together with the link to the Free and Informed Consent Form and the sociodemographic and clinical questionnaire. Participants were instructed to read the ICF carefully for possible clarification of doubts regarding the study and after that, they proceeded to the sociodemographic and clinical questionnaire. At the end of the study, 17 responses were collected from the research participants. To prepare the database , the tabulation was performed using Microsoft Excel software . The descriptive analysis of the data was performed using the Statistical Package for Social Sciences software (IBM SPSS), version 21. 0 for Windows. Normality was verified using One-Dimensional Descriptive Statistics. Categorical variables were analyzed using frequency (%).

RESULTS

The research was carried out, using a sample of 17 participants. In the group, 52.9% (n = 9) are aged between 25 and 34 years, with training time between 1 and 3 years, corresponding to 41.2% (n = 7) of the interviewees, where 58.8% have specialization as the highest degree. In addition, 29.4% (n = 5) works in the private network with SUS accreditation, 23.5% (n = 4) works only in the public network and 23.5% (n = 4) works in the public network and in the private network, 35.3% (n = 6) work in the sector of general intensive care unit and intensive care unit dedicated to patients with COVID-19 (Table 1). Regarding clinical data, 58.8% (n = 10) report that they frequently use Manovacuometry as an assessment tool, 68.8% (n = 11) use an analog instrument to assess inspiratory muscle strength, 62.5% (n = 10) uses the Neder Formula as a criterion for defining the normal values of Pimax and 29.4% (n = 5) uses the Neder Formula and the Pereira Formula. 50% (n = 8) physiotherapists uses m Manovacuometry and 50% (n = 8) and Manovacuometry ultrasound examinations as complementary to the beginning of treatment with the TMI. When asked to the group, if patients with COVID-19 present changes in respiratory muscle strength, 68.8% (n = 11) answered that frequently (Table 2), and 64.7% (n = 11) reported that they frequently Inspiratory Muscle Training (IMT) has been used as a treatment strategy for critically ill patients with COVID-19 (Figure 1).

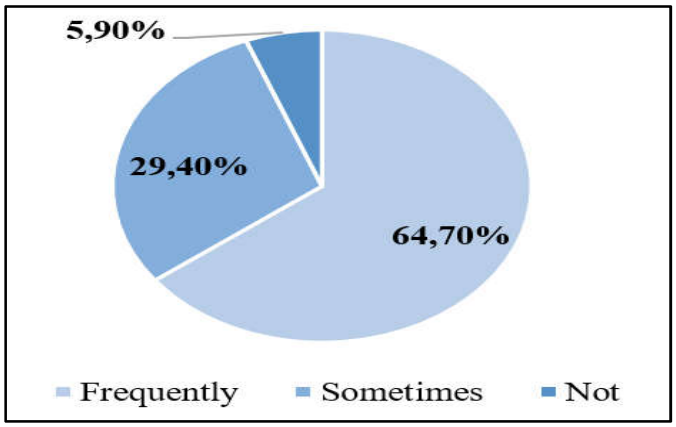
Table 1. Sociodemographiccharacteristics of the sample Vitória da Conquista, Bahia, 2020

Variable	% responses	n	%
What is your age?	100		
Between 25 and 34 years		9	52.9
Between 35 and 44 years		6	35.3
Between 45 and 54 years		2	11.8
Academic training time	100		
Lessthan 1 year		2	11.8
Between 1 and 3 years		7	41.2
Between 4 and 6 years		6	35.3
Above 6 years		2	11.8
Higherdegree	100		
Universitygraduate		2	11.8
Specialization		10	58.8
Master's		5	29.4
Hospital location	100		
Private network		3	17.6
Public network		4	23.5
Private network with SUS accreditation		5	29.4
Private Network, Public Network and Private Network with SUS accreditation		1	5.9
Private Network and Public Network		4	23.5
Hospital location	100		
Nursery		3	17.6
General IntensiveCare Unit		1	5.9
COVID-19 IntensiveCare Unit		2	11.8
General IntensiveCare Unit and COVID-19 IntensiveCare Unit		6	35.3
COVID-19 IntensiveCare Unit and Infirmary		4	23.5
Outpatient, Infirmary, General IntensiveCare Unit and COVID-19 IntensiveCare Unit		1	5.9

Table 2. Clinical data Vitória da Conquista, Bahia, 2020

Variable	% responses	n	%
During clinical practice, do you use manovacuometry as an assessment tool?	100		
Often		10	58.8
Sometimes		6	35.3
I don't use		1	5.9
Whichinstrumenttoassessinspiratorymusclestrength do you use?	94.1		
Digital		5	31.3
Analog		11	68.8
Whichcriterion for defining Pimáx normalityvalues do you use the most?	94.1		
Neder formula		10	58.8
Pereira Formula		0	0
Neder formula and Pereira formula		5	29.4
From the device		1	5.9
Has it beennotedwhetherpatientswith COVID-19 havechanges in respiratory musclestrength?	94.1	11	68.8
Often		5	31.3
Sometimes		0	0
Not			
WhichcomplementaryexamS are requestedto start treatmentwithInspiratory Muscle Training?	94.1		
Manovacuometry		8	50
Manovacuometry and Ultrasonography		8	50

Source: Research data (2020)



Source: Research data (2020).

Figure 1. HasInspiratory Muscle Training beenused as a treatmentstrategy for criticallyillpatientswith COVID-19?

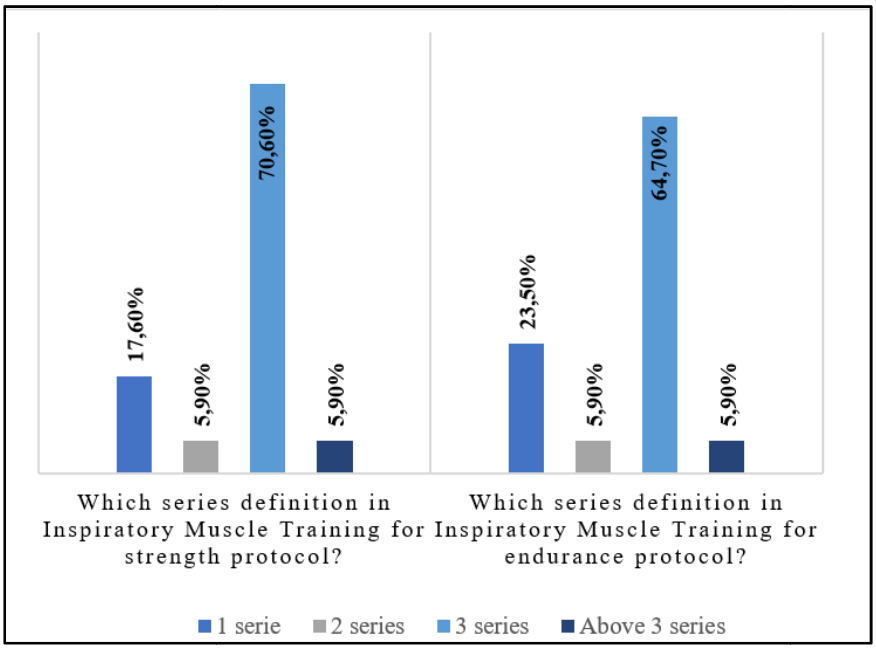
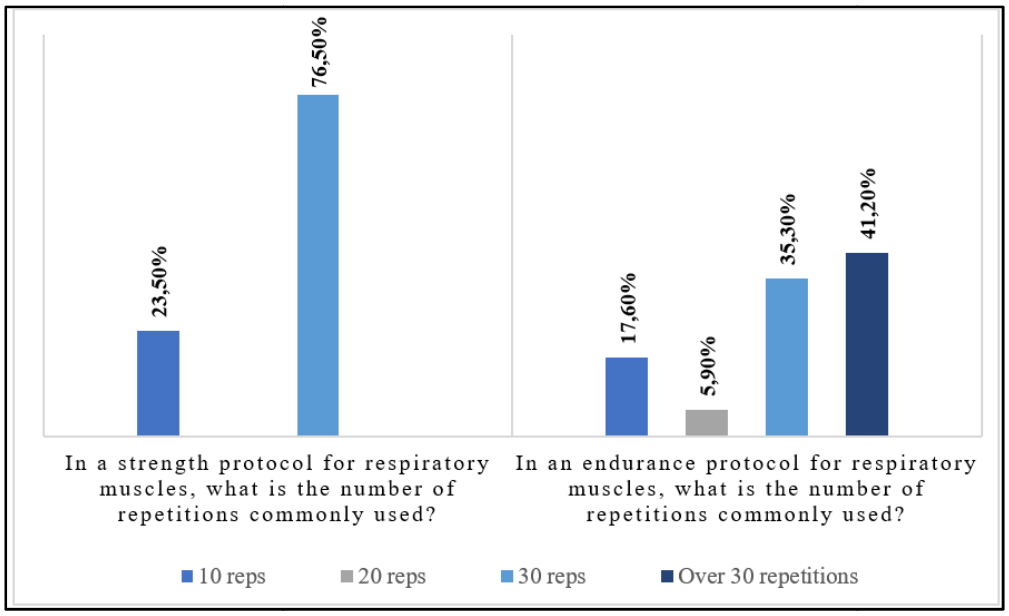


Figure 2. Definition of series for strength and endurance protocolused in Inspiratory Muscle Training



Source: Research data (2020).

Figure 3. Definition of repetitions in the strength and endurance protocolsapplied in Inspiratory Muscle Training

According to 58.8% (n = 10) of the interviewees, the IMT improves the patient's functional capacity, 58.8% (n = 10) uses the linear mechanical load model, 88.2% (n = 15) uses the continuous training method, 82.4% (n = 14) uses 40% of the load Pimax for the endurance increment protocol, for strength increase protocol, 47.1% (n = 8) uses 70% of the Pimax. Regarding the definition of series, 70.6% (n = 12) defines 3 series for the strength protocol, 64.7% (n = 11) defines 3 series for the endurance protocol (Figure 2) , 76.5% (n = 13) uses 30 repetitions in the strength protocol for respiratory muscles, 41.2% (n = 7) uses more than 30 repetitions in the endurance protocol for respiratory muscles (Figure 3). The time interval between the inspiratory muscle training series in the strength protocol, 52.9% (n = 9) adopts 60 seconds and 47.1% (n = 8) 30 seconds; in the endurance protocol 47.1% (n = 8) adopts 30 seconds, 47.1% (n = 8) adopts 60 seconds and 5.9% (n = 1) 120 seconds.

Of the respondents, 47.1% (n = 8) used the *Powerbreathe Classic* model as equipment to perform the Inspiratory Muscle Training, 23.5% (n = 4) used *Threshold* PEP and 17.6% (n = 3) uses the two models, namely: *Threshold* PEP and *Powerbreathe Classic* model . Regarding accessories during the IMT practice, 47.1% (n = 8) only use a filter nozzle, 29.4% (n = 5) only a simple nozzle and the others use the HEPA filter, the HME filter, nozzle Simple and filter nozzle, simple nozzle, filter nozzle and HEPA filter together.

DISCUSSION

According to the studies by Silva *et al*. (2020), the 19-COVID cause various changes in the respiratory tract, leading to deficiency in f unction d the respiratory muscles ed to exercise tolerance, involving the respiratory capacity and mobility.

Shi *et al*. (2020), reports that the muscles respiratory command alveolar ventilation and its resulting weakness in acute respiratory failure, extending ing time n mechanical ventilation and increases ing mortality. These effects are commonly presented by critically ill patients with COVID-19, revealing the severity of the disease. The author also in this study compared evidence of expression of the angiotensin-converting enzyme 2 involved in the development of fibrosis in the diaphragm in patients admitted to ICU COVID-19 and patients in conventional ICU. The results obtained in the study demonstrated that ICU COVID-19 patients showed a significant increase in the genes involved in diaphragmatic fibrosis, while the myopathic enotype was distinctly different from conventional ICU patients.

In several studies, it is stated that some physical therapy strategies are highly effective in the treatment of COVID-19 and within the hospital environment, Inspiratory Muscle Training has become the best technique for improving functional capacity and increasing the resistance of the diaphragm. Pedrosa (2016) , states that TMI follows the training principles of skeletal muscles: specificity, is associated with specific adaptations of a system or muscles being exercised; overload, addresses that to generate strength, the training load must be greater than the usual load and needs to be adjusted during the training protocol; the duration and frequency of training will determine the time and magnitude of the muscle response; and the reversibility that brings the concept that the muscle will, at some point, return to the initial baseline if the training is removed. The main benefits of IMT in respiratory disorders are increased strength and endurance of inspiratory muscles, increased tolerance to physical exercise, increased chest expansion, reduced metaborreflex, decreasing dyspnea, adequacy of breathing pattern and improved quality of life. (CABRAL, 2016). The present study analyzed the applicability of Inspiratory Muscle Training through an assessment of clinical practice. The data collected showed that 64.7% (n = 11) of physical therapists professionals frequently use Inspiratory Muscle Training as a treatment strategy for COVID-19. In addition, the study revealed that 68.8% (n = 11) of patients with COVID-19 present changes in respiratory muscle strength. S ccording to still study, 58.8% (n = 10) of respondents stated that the TMI improves the functional capacity of the patient. This s result s can m be justified due to the widespread use and effectiveness of muscular inspiratory muscle training in the hospital environment in disorders of the respiratory muscles affecting the functional capacity, strength and endurance of the respiratory muscles. Few studies have been found in the literature regarding inspiratory muscle training in the treatment of patients with COVID-19. A study by Felten-Barentsz *et al*. (2020), on recommendations to hospital physiotherapists who treat patients with COVID-19, reports that inspiratory muscle training was highly effective in several protocols lasting only 4 weeks.

However, there is an enormous scope on the effectiveness of Inspiratory Muscle Training in other respiratory pathologies that present clinical characteristics similar to those of COVID-19. A study by Chiappa (2003), analyzing the effectiveness of inspiratory muscle training in patients with heart failure (HF) demonstrated that after 12 weeks of treatment, patients showed increased inspiratory muscle strength and endurance, improved functional capacity and decreased oscillation ventilation during cardiopulmonary testing.

Other studies that address inspiratory muscle training in patients with Chronic Obstructive Pulmonary Disease (COPD) report divergences in their results. Figueiredo, Azambuja and Sbruzzi (2019) stated that after a systematic review of the literature, isolated IMT improves inspiratory muscle strength and functional capacity, with no impact on lung function, dyspnea and quality of life , but associated with another intervention, it showed only increase in inspiratory muscle strength. The study by Manfroi *et al*. (2019), evaluated the effect of TMI in strength, dyspnea and exercise capacity in patients with COPD and I nsuficiência C Ardiaca. The results demonstrated that the IMT seems to be effective in improving the inspiratory muscle strength, exercise tolerance, dyspnea and inspiratory muscle weakness of the studied patients. The present study had as main limitations the complete lack of knowledge about strategies and treatment for COVID-19, the short period of time for data collection and small sample. However, the main advantage of this study is precisely the exploration of new and effective physiotherapeutic strategies in the treatment of COVID-19, enabling knowledge and application of its own within the work environment of physiotherapy professionals.

Conclusion

The results of the evaluation of the clinical practice present in this study showed that, there is wide applicability of the Inspiratory Muscle Training in patients with COVID-19. This result is important to support the conduct of physiotherapists who seek new effective strategies in the treatment of a highly dangerous and little-known virus. Thus, it is suggested that the use of inspiratory muscle training in patients with severe COVID-19 is a capable resource to improve functional capacity, aument air force and muscular endurance inspiratory and consequent improvement in the patient 's quality of life. In addition to this, the use of IMT is effective in reducing the length of hospital stay and consequently minimizing the effects of the syndrome of after intensive care. Therefore, it is necessary that further studies are carried out, further exploring the effectiveness of TMI in COVID-19.

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