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RESEARCH ARTICLE

REFLECTIVE ANALYSIS OF LONG-COVID INFORMING EXERCISE PROFESSIONALS AND MANUAL THERAPISTS SPECIALIZING IN FASCIA FOCUSED THERAPEUTIC INTERVENTIONS

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ABSTRACT

This research paper provides recommendations, based on a reflective analysis, concerning the prescription of safe, effective, and appropriate fascia-focused physical activity, and manual therapy interventions, for patients recovering from COVID-19. In particular this review and emerging recommendations are specific to those who are failing to achieve a full recovery and thus experiencing Long-COVID symptoms leading to a possible National health crisis. The progression of the airborne RNA virus, identified as severe acute respiratory syndrome coronavirus (SARS-CoV-2) or COVID-19, is ongoing, and the numbers of Long-COVID suffers are increasing. It is now almost two years since the World Health Organisation (WHO) announced that the spread of this airborne virus had reached pandemic proportions. It is hoped this research paper will provide important information concerning the longer-term effects of COVID-19 and its numerous variants Alpha, Delta, Delta plus (K417N spike protein mutation), Lambda and others. Appropriate guidelines for safe physical activity and touch therapies for hospitalised and non-hospitalised long-COVID patients will be provided. There is emerging detail concerning long-termpost-viral effects showing them to be similarly reflective of other common syndrome sequelae such as Fibromyalgia, Myalgic Encephalomyelitis, Myofascial Trigger Points, and Chronic fatigue. This information is proving to be useful in offering much-needed recommendations for the safe prescription of physical activities and manual therapy in supporting patient's return to pain-free movement and improved quality of life. While high-quality research is lacking on this topic, according to reliable scientific sources, long-COVID syndrome, or Long-COVID, is an emerging and growing problem worldwide. Several reports confirm that a significant number of people are failing to achieve full recovery following infection. Available research figures show patients who did not require hospitalization when having COVID-19 and who had no underlying medical condition including children, healthy fit individuals, particularly women, and 'under 40' pre-menopausal women are particularly vulnerable to Long-COVID. This reflective analysis provides recommendations concerning informed, appropriate fascia-focused therapeutic physical activity and touch-therapy therapeutic interventions for qualified therapists working with hospitalised or non-hospitalised Long-COVID patients. Based on current data, it seems prudent to consider SARS-CoV-2, COVID-19 as a long-term illness. Post-Covid patients require professionally trained personal to provide the necessary clinical support and valuable functional life change advice. Following medical approval, if required, qualified therapist should carry out a complete battery of tests to rule out other underlying causes before providing any therapeutic interventions.

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INTRODUCTION

According to the Centers for Disease Control and Prevention (CDCP) current technology has allowed for bespoke investigatory applications into gene function, providing the basis for a greater understanding within the shortest possible time frame leading to effective vaccinations. While several hundred coronaviruses currently exist, to date, no animal gene pool source for this novel virus has been found, however, this pandemic has been classified as a zoonotic disease (1,2). What is known with reasonable scientific certainty is the air-borne aetiological agent COVID-19 (SARS-CoV-2) gains access to

the human body through the eyes, nose, and predominantly the mouth (2). Fascia is universally present in the body, providing a plausible explanation concerning the novel COVID-19 reaching, penetrating, impacting and infecting cells of every organ in addition to blood vessels, myofibroblasts, and the membrane of fat cells leading to wide-ranging symptoms (1, 5). While a number of countries are seeing a significant drop in the number of cases more countries are witnessing overall numbers continuing to grow, in particular, due to the variant Delta now being the most significant source of infection (1, 2, 20). Genomic analysis research has shown SARS-CoV-2 to be phylogenetically associated with bat viruses providing a possible link to bats being the primary reservoir (29).

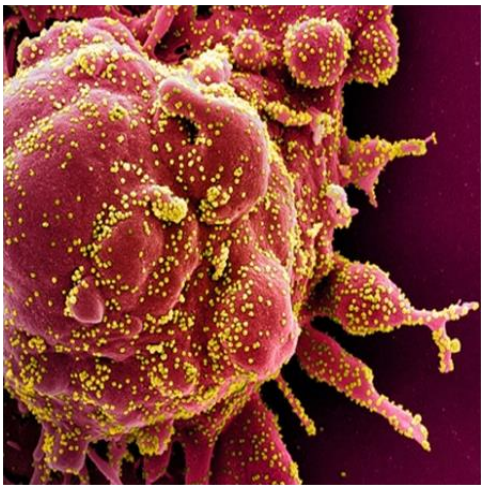

Fig 1. Novel Coronavirus SARS-CoV-2

Colorized scanning electron micrograph of an apoptotic cell (red) heavily infected with SARS-COV-2 virus particles (yellow), isolated from a patient sample. Image captured at the NIAID Integrated Research Facility (IRF) in Fort Detrick, Maryland. Credit: National Institute of Allergy and Infectious Diseases, NIH.

Fascia is associated with a metallopeptidase angiotensin-converting enzyme 2 also known as ACE2. Fascia is the ubiquitous connective tissue of the body and has been described as the "Universal singularity" (2). A clearer picture is emerging with time concerning the long-term health consequences for a significant number of SARS-CoV-2, COVID-19 survivors (4, 5). Long COVID, Post-COVID Syndrome, Long haulers and Post Viral Fatigue Syndrome are some of the terms currently being used to describe a condition that people with continuing, often painful, symptoms beyond 12 weeks following initial infection of COVID-19 are experiencing (1, 4, 5). According to White House Chief Medical Advisor and leading viral expert Dr. Anthony Fauci, post-COVID symptoms have been reported nine months after initial infection, however research is lacking concerning longer-term sequelae (5). While most hospitalized patients recover, reports confirm that covid-19 patients have an increased risk of mortality and organ dysfunction (3,4). Long-COVID sufferers include patients who did not have underlying medical conditions and did not need initial hospitalization and yet are experiencing long-lasting debilitating symptoms (5). As many as 87.4% of patients reported fatigue, joint pain, multiorgan dysfunction and other debilitating symptoms after recovery or discharge from hospital (5, 6, 7).

With growing numbers of people suffering with painful and often debilitating long-COVID symptoms, it is crucial that with an absence of peer reviewed, gold standard research, action should now be taken to inform patients of safe, effective, appropriate activity and touch therapy interventions to help ease pain, increase motion and improve quality of life (2). Safe guidelines can be provided as science based evidence currently exists for the treatment of special populations (13). Using simple metrics the number of persons infected with SARS-CoV-2, COVID-19, as reported by the European Centre for Disease Prevention and Control (ECDPC) at the time of publication, was 256 million people worldwide with that number growing, especially due to the Delta, Delta plus and Lambda variants (1). Values concerning the percentage of Long-COVID patients are estimated to be at least 5% of patients while one study found that 30% of patients reported persistent symptoms (5).In the UK 79% of currently sequenced and genotyped cases have been identified as the variant Delta while other reports put that figure at or above 90% (19). According to recent research the Delta variant is hyper-contagious spreading at a rate two times faster than the original COVID with viral loads that are one thousand times higher and more infectious due to its rapid growth (1). Concerns regarding the persistent long-term effects of post COVID infection have been reported (1, 22). The number of theories and hypotheses surrounding the origins of biological entities known as RNA viruses, is tortuous and convoluted (23). Today, evolutionary virologists support their views based on data derived from gold standard proteomics research and revolutionary 21st century inspired scientific technology (24). Colorized scanning electron micrograph of an apoptotic cell (red) heavily infected with SARS-COV-2 virus particles (yellow), isolated from a patient sample. Image captured at the NIAID Integrated Research Facility (IRF) in Fort Detrick, Maryland. Credit: National Institute of Allergy and Infectious Diseases, NIH.

New variants such as K417N/T, N501Y, K117, B.1.351, V501Y.V2, B.1.1.7, B.1.351, B.1.617or 20J/501Y.V3, show good efficacy with current vaccinations, however, variant Delta, Delta plus and Lambda variant (C.37) are impacting long-covid as current vaccinations have less efficacy against these newer variants (6). It is estimated that a significant number of recovered adult patients could experience long-covid with a presence of underlying chronic conditions possibly due in part to significant cell apoptosis and vascular damage resulting in leakages a response to pro-inflammatory cytokines (7). Post-mortem analysis of lung sections retrieved from deceased COVID-19 patients found apoptosis, necroptosis and significant cell inflammatory penetration accompanied by necrotic cell debris and pulmonary interstitial fibrosis (Fig 1). A recent review by the British National Institute for Health Research (NIHR) suggests that Long COVID should be considered a combination of separate syndromes, phenotypes, or clusters (11). This being the case, Irelands National Training Centre (NTC) have issued guidelines stating it is prudent to take a multi-disciplinary management approach utilizing various specialties, including a focus on primary and secondary care (13). The ubiquitous symptoms of long-covid involve debilitating symptoms including, but not limited to, sleep apnoea, disorientation, tachycardia, extreme prolonged fatigue, rash, impaired autoimmune issues, body-wide aches and joint pain, shortness of breath, lack of sleep, joint stiffness, backache, palpitations, chest pain, tooth, mouth and throat pain, dizziness, diarrhoea, stomach pain, loss of appetite, rashes, intermittent fever,

inflammation of the myocardium, acute kidney injury, long-term loss of smell, taste and change in mood (5). Specific brain-related symptoms include blurred vision, headaches, confusion, hallucinations, delirium, depression, concentration difficulties, cognitive impairment, brain fog and anxiety (18, 19). Fascia-focused manual and movement therapeutic interventions should be tailor-made to tackle anindividual's unique post-COVID structural and physiological deficits (13). Personalized physical activity supported by tailored recovery intervals has been shown to play a key role in boosting and modulating human immune function (10). Appropriate low-intensity physical activity provides a significant enhancing of immune function involving increased interleukins, nitric oxide, cytokines, natural killer cells, neutrophils, superoxide anion, and interleukins (11). Personalized physical activity increases blood and fluid circulation, increasing the supply and availability of anti-inflammatory white blood cells within the interstitium (10). The interstitium has recently been defined as a continuous reticular network throughout, between and within all tissues and organs (19, 30). This interstitial fascial network has been proposed as the possible highway upon which the SARS-CoV-2, COVID-19 may travel to gain access to every organ and tissue (2).

Immune enhancing fluid infiltrates the fascial interstitial spaces providing a gateway to the lymphatic vasculature and a return to the venous circulation (19). Newly established Long-COVID 'National Standards and Guidelines (NSG's) by Ireland's National Training Centre (NTC) include the need for doctor's approval, when necessary, before prescribing physical activities to Post-COVID patients (13). Fascia-specific mobilization activities should take into consideration each patient's capacity for increased intensity while giving due care to age, appropriate recovery time, frequency, duration, and intensity-based parameters (13). Interestingly, a "muscle centric" focus has been deemed inappropriate for Post-COVID or Long-Covid patients in the early recovery stages as tissue renewal rate for densified fascial structures, such as tendons and aponeurosis, (Fig 2) is significantly slower than muscle fiber (23).

Figure 2 Tissue renewal rate for densified fascial structures (White) such as tendons and aponeurosis is significantly slower than muscle fibers (Red). Image: Sharkey, J 2020

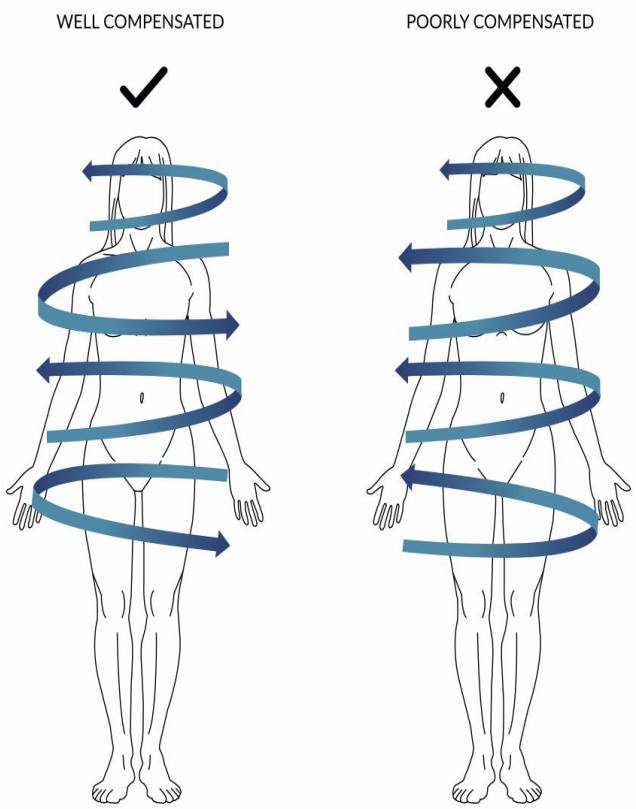

Figure 3. Zink and Lawson assessment protocol helps establish hierarchy concerning the descending or ascending nature of the dysfunctional fascia adaptation pattern

High load physical activity focusing on muscle fibre hypertrophy results in complex structural alterations including degradation of the fascial matrix (14). Long-COVID patients are reported to have significant wide-spread degradation of myofascial tissue and therefore avoiding strength training in the initial recovery stage is recommended (15). Focusing on muscle strength may result in tendon and aponeurotic strain due to transductive tissues exceeding their physiological threshold as a result of muscle fibre atrophy especially following critical illness (16, 28, 31).

Due to the most frequent symptoms reported in post-COVID syndrome it is recommended to have a primary focus on improving overall respiratory function, fatigue, joint mobilisation, heart health, osseofascial function (i.e., tendon health, aponeurosis, bone health), proprioception and neuromuscular efficiency (16, 13). NTC protocol for introduction, or return, to safe and effective aerobic activity for post-COVID-19 recovery is based upon best practice experience working with specialist populations supported and informed by evaluating physical function (13). In the absence of established international protocols for post-COVID-19 heart rate training, NTC recommends that each patient is considered on an individual basis utilizing low intensity aerobic activity initially ranging between 30% up to 55% of max heart rate (13). Suitably qualified professionals should prescribe low intensity, short duration, personalized, graded, integrated physical activity. Activities should have a focus on whole-person, age-related, functional, multi-planar activities. In addition care should be taken to monitor patients for arrhythmias, tachycardia, undue shortness of breath, difficulty reverting to baseline respiratory rate, difficulty with swallowing, unnecessary pain on movement, prolonged or excessive fatigue (13).

According to Ireland's National Training Centre (NTC) therapists should give special attention to pharmacotherapy, its impact on organ activity during exercise, patient education, and behavioural therapy (13). With respiratory compromise having been identified as a primary issue in post-COVID patients, a particular focus on improving overall peak/max VO2 is recommended to improve diaphragmatic weakness (11). Type-1 muscle fibers are specifically targeted by utilising low-intensity activities that avoid depletion of oxygen (15). Fascia and muscle fibers exhibit significantly different rates of protein degradation and protein synthesis with fascia requiring more time to allow for appropriate recovery and to avoid overtraining or undue strain (27). Manual therapists should investigate soft tissues related explicitly to the function of effective load transfer between the spine and limbs. Such an investigation is constructive and beneficial when there is no clearly identified underlying pathology for explaining felt or perceived fascial restrictions (16). The Zink and Lawson assessment protocol is additionally recommended to manual and movement therapists as an effective assessment tool to identify common fascial compensatory patterns (8). Therapists should ensure each patient has the energetic capacity to integrate neurovascular and morphogenic changes to the fascial net due to manual or movement interventional therapy (24). A positive Zink and Lawson test (i.e., poorly compensated) has been identified as a reliable tool to guide the therapist concerning the most appropriate time to introduce site-specific or local, fascia-focused interventions (8).A positive test calls attention for a more global, holistic set of interventions such as lifestyle modifications, focus on nutritional deficits, prescribing low intensity physical activity supported by appropriate recovery intervals, hygienic sleep routines, improving breathing pattern disorders and posture as the foundation upon which to build recovery (25). A negative Zink and Lawson test (i.e., well-compensated) provides an additional degree of confidence, queuing the therapist in a temporal fashion informing that local soft tissue therapeutic interventions such as site-specific fascia tuning peg work, myofascial trigger point deactivation, osseofascial techniques, muscle energy techniques, positional release, and related low-intensity manual applications can be introduced safely (25). In addition, the Zink and Lawson assessment protocol has been demonstrated to be helpful in establishing hierarchy concerning the descending and/or ascending nature of the dysfunctional fascia net adaptation pattern (Fig 3).

Conclusion

Recent research reported in the British Medical Journal (BMJ)highlighted future substantial healthcare issues associated with the long term burden of covid-19 on hospitals (26). To ensure government health systems and hospitals are not over-rundue to the demands oftreating long-covid patients a recommendation for specialists trained in the treatment of long-covid symptoms through appropriate exercise and manual therapyis proposed (2). It is recommended that a multi-disciplinary approach should be utilised following an appropriate risk stratification and doctor's approval, if necessary (13). Manual and movement therapists working with Long-COVID patients are advised to employpragmaticlow intensity interventions and activities that have a focus on short duration, personalized, graded, integrated physical activities that provide a whole-person focus that is age-related, functional and multi-planar. A number of health concerns regarding exercise prescription for post-COVID patients have been identified (10).

Therefore, it is imperative that patients displaying symptoms of a cardiac nature or worsening symptoms generally should cease activity and seek medical approval before continuing with physical exercise (13). With a dearth of evidence on this specific topic, although what evidence there is suggests that risks are low, caution is advised when prescribing myofascial focused physical activity or offering hands-on fascia focused therapy following viral infection. Patients who required hospitalisation and particularly patients who received critical interventions may require a more complex approach to returning to physical activities and manual therapy. Loss or wasting of muscle fibres, or atrophy, is a complex multifactorial issue impacted by the specifics of an individual patientsexperience resulting in functional impairment (27). Factors to consider include the patient's age and health, duration of time required in bed/hospital, severity and type of illness resulting from infection, secondary illnesses and infections (as a result of or prior to infection), sepsis, hyperglycaemia, organ failure and respiratory stress (17). With a lack of empirical evidence it is hoped the recommendations in this paper will prove valuable in efforts to assist people suffering with the long-covid to return to health and pain free lives.

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