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Comprehensive Hand Rehabilitation in Secondary Raynaud's Syndrome: Case Study

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Abstract: ***Introduction: Raynaud's syndrome is a disorder that affects small blood vessels in your fingers and toes. It may also affect blood vessels in your nose, lips or ear lobes. Raynaud's causes you to have episodic spasms, called vasospastic attacks, in response to cold temperatures or stress. A case study of a 20 years old female secondary Raynaud's syndrome subject. She is unable to perform basic hand function with her left hand. Medical examinations show the antinuclear antibodies test (ANA) is positive, autoimmune test MCTD, SSC is positive and TSH T4 is positive. On examination discoloration of the left index finger, ROM of index finger is reduced, muscle strength of left hand reduces, weak grasp, in sensory examination temperature sensation is absent and unable to recognize the texture with left index finger. Methodology: The patient was observed both before and after the treatment using an outcome measure were stockholm workshop scale, finger goniometry, hand dynamometer, pinch gauge. Result: Four weeks of occupational therapy programme was given and focus on improving range of motion (ROM) at the interphalangeal joint of hand and 2nd metacarpophalangeal joint, work on improving the strength of interphalangeal and metacarpophalangeal joint, sensory re-education for sensory loss, enhancing hand function and preventing from further deformity.***

Keywords: Raynaud's phenomenon, Hand function, Interphalangeal joint, Metacarpophalangeal joint

1. Introduction

Raynaud's syndrome is an episodic, vasospastic disorder typically characterized by digital vascular compromise following exposure to cold and/or emotional stressors (1). There are two types of syndromes: primary phenomenon and secondary phenomenon. The majority (80–90%) of individuals have primary ('idiopathic') RP (PRP), whereas secondary RP (SRP) can occur due to a broad range of medical conditions and drug-related causes (1). PRP presents as symmetrical vasospasm, usually affecting both hands, brought on by a number of stimuli including cold and emotion, but also carrying objects. It tends to begin at a younger age than secondary RP. It mainly occurs in young women in their teens (2). Secondary RP occurs in 90% of patients with systemic sclerosis, in 30% of patients with systemic lupus erythematosus, and in about 20% of patients with rheumatoid arthritis. In secondary RP, vasospastic attacks are caused due to structural or biochemical changes in the vessel wall., Symptoms of secondary RP are more severe and justify more intense treatment than in primary RP. The prescription of drugs plays a more important role in the treatment of secondary RP than in primary RP (3)

Table I: The conditions which may be associated with secondary RP
(with reference of ESVM guidelines – the diagnosis and management of Raynaud's phenomenon) (2)

Connective tissue disorders • Systemic sclerosis (SSc) • Mixed CTD • Sjögren's syndrome • Dermatomyositis/polymyositis • Primary biliary cirrhosis (often with underlying SSc)
Occupational • Hand arm vibration syndrome and hypothenar hammer syndrome – Silica and solvents (causing systemic sclerosis)
Drugs • Anti-migraine drugs e. g. ergot derivatives • Non-selective β blockers, including eye drops • Some cytotoxic drugs • Cyclosporin (though may be obstructive especially in transplant patients) – Cocaine or substance abuse • Estrogen replacement therapy without progesterone
Endocrine • Hypothyroidism • Pheochromocytoma
Miscellaneous • Low body mass index – Following bariatric surgery • Complex regional pain syndrome • Digital injury

The sign and symptoms of Raynaud's phenomenon is classically described with a triphasic color change of the digits with initial white or pallor (ischemic phase), then blue or cyanosis (deoxygenation phase), followed by red or erythema

(reperfusion phase). A typical attack may last less than an hour but can also persist for hours. Secondary Raynaud's will describe attacks that are more frequent, painful, often asymmetric and may lead to digital ulcerations, reducing the ROM and strength of joint involves (4).

Screening questions should include:
1) Are your fingers unusually sensitive to the cold?
2) Do your fingers change color when they are exposed to cold temperatures?
3) Do they turn white, blue, or both?

If there is presence of all three symptoms it generally diagnosis as Raynaud's phenomenon (http://www.nhlbi.nih.gov/health/health-topics/topics/raynaud)

Diagnosis of Raynaud's phenomenon depends on the patient's history which includes frequency of attack, numbness, paranesthesia, any history related to CTD and associated problems such as photosensitivity, mouth ulcers, drying of mouth. Occupational history also plays an important role in diagnosis of Raynaud's phenomenon. Primary diagnosis tests include antinuclear antibody (ANA), Capillary microscopy, Secondary diagnosis tests are vascular test plethysmography, cold challenge (2). General management including lifestyle changes, education of the patient and avoidance of trigger conditions. It is important to advise patients to protect themselves from the cold.

Pharmacological treatment includes Calcium channel blockers, vasodilators, Intravenous treatment with PGI2, Endothelin-1 receptor antagonists. Surgical management. Surgical operations to remove some terminal phalanx, occasionally amputation is necessary in secondary care (2).

Due to vascular, mobility, and strength impairments, the individual with RP has more difficulty in performing activities of daily living (ADLs) that are connected to their line of work since they have a high degree of upper extremity disability.

The aim of this study was to investigate a comprehensive 4 weeks intervention that improved hand function in secondary Raynaud's phenomenon with inflammatory symptoms. The intervention consists of positioning of hands, stretching, Thera Putty for hand workout, and hydrotherapy.

2. Case Report

A 20-year-old female has been experiencing pain in her left index finger for the past two months and bluish discoloration with weakness in her left hand for the past month. She was asymptomatic two months ago, but then developed acute, gradually worsening symptoms that began at the tip of her left index finger and spread to the entire finger within 15 days. The pain in her left index finger is accompanied by electric shock-like sensations throughout her left limb, starting distally and moving proximally. She is unable to perform her job as a handcraft artist (jadi) and has difficulty holding objects with her left hand due to the acute onset of pain. She noticed the weakness after waking up, despite being normal the previous night. Medical examinations reveal positive results for antinuclear antibodies (ANA), autoimmune tests for MCTD and SSC, and TSH T4. On examination, the range of motion (ROM) of her index finger is 25 degrees, which is below the normal range. The manual muscle testing (MMT) score for her index finger is 2. Superficial sensory examination shows no sensation, but deep sensation is intact as she responds to pain.

3. Methodology

A single case study of a 20 years old female with diagnosis of Raynaud's phenomenon was considered. The initial assessment done before the protocol given and after the post training assessment was done after 30 days. Four outcome measures were considered to assess the progress of the patient's hand strength.

3.1 Outcome measures

Outcome measures considered are Stockholm workshop scale, DASH questionnaire, finger goniometry, hand dynamometer and pinch gauge.

3.1.1 Stockholm workshop scale (SWS)

The SWS for staying the hand arm vibration syndrome, Raynaud's phenomenon. It is a symptomatic and diagnostic method for hand arm vibration syndrome and Raynaud's phenomenon (5). It contains two symptom categories: vascular symptoms and sensorineural symptoms in table 2.

Table 2: Stockholm workshop scales (5)

Stage	Grade	Description
Vascular		
0		No attacks
1	Mild	Occasional attacks affecting only the tips of one finger
2	Moderate	Occasional attacks affecting distal and middle phalanges of one or more fingers
3	Severe	Frequent attack affecting all phalanges of most fingers
4	Very Severe	As in stage 3 with trophic skin changes in finger tip

Sensori-neural	Symptoms
0 SN	Exposed to vibration but no symptoms
1SN	Intermittent numbness with or without tingling
2SN	Intermittent or persistent numbness, reducing sensory perception
3SN	Intermittent or persistent numbness, reducing tactile discrimination and manipulative dexterity

3.1.2 Goniometry

A goniometer is a device that measures angles or allows the rotation of an object to a precise position. According to the case study, the normal ROM for the metacarpophalangeal joint is 90 degrees of flexion and 45 degrees of extension, the proximal phalangeal ROM is 100 degrees flexion, and the distal phalangeal ROM is 90 degrees flexion. The observation range

of motion of the subject is mentioned in table 3.

3.1.3 Hand dynamometer

Hand dynamometer is used to assess the grip strength of the hand. This assessment requires the subject to exert maximum isometric force while holding the dynamometer stationary. To measure the recording of the hand dynamometer, the subject's elbow should be flexed at 90 degrees. The subject should then press the dynamometer as hard as possible (6). The normal range in between for females age group 20 to 24 is 27.7 SD 6.6 KG for left hand and right-hand range is 31.9 SD5.9. The grip strength reading is the average of three recordings. The reading is mentioned in table 3

3.1.4 Pinch Gauge

The Pinch Gauge measures hand strength by assessing fingertip, key, and palmar pinch force (7). It can be used as a diagnostic tool or to monitor rehabilitation progress. To use it, the individual simply applies pressure with their thumb to the gauge. The reading is mentioned in table 3.

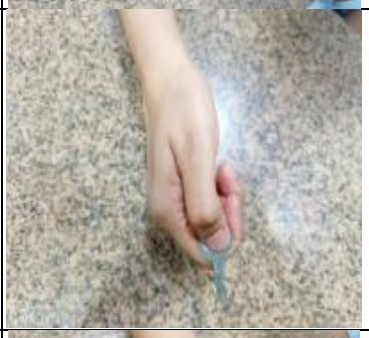
3.1.5 DASH

The Disabilities of the Arm, Shoulder, and Hand (DASH) questionnaire is a self administered tool designed to assess disabilities and symptoms specific to the upper extremities. It primarily consists of a 30-item scale that measures disability and symptoms. Each item has 5 response choices, ranging from "no difficulty or no symptom" to "unable to perform activity or very severe symptom", and is scored on a 1- to 5-point scale (8).

Dash disability / symptoms SCORE = [(sum of n responses) - 1] x 25 / n
where n is equal to the number of completed responses.

4. Treatment Protocol

The subject underwent hand rehabilitation through a series of Thera putty exercises. These exercises included forming a ball with the Thera putty using one hand, placing it between the fingers, and compressing it. Subsequently, a roll was created with one hand, squeezed using a pincer grip with the thumb and index finger, and then wrapped around all fingers to form a ring. The hand was then opened against the resistance of the Thera putty (9). The involvement of the left index finger suggests radial artery involvement. The radial artery runs through the fascia of the forearm, situated between the brachioradialis and the tendon of the flexor carpi radialis. Restriction in the fascia surrounding the radial artery can reduce blood flow along the vessel to the palmar digital arteries in the hand. Fascial strokes over the superficial and deep front of the arm, moving distally from the coracoid process, biceps brachii, radial tuberosity, scaphoid, thenar muscle, and ending at the lateral thumb, can alleviate this restriction (10). Sensory re-education training was provided, instructing the subject to move the tactile stimulus from the proximal to the distal direction of the wrist, switching from a soft to a hard texture. Active assistive ROM exercises are recommended for the wrist to enhance joint mobility in the hand. Goal oriental activity also provided. The treatment continued for 4 weeks, with sessions held 5 days a week, twice a day. Each exercise was repeated for 15 times during these sessions, ensuring consistent therapy throughout the duration

No	Exercise Demonstration	Instructions
1		SPREAD FINGERS Put the hand on table and spread the finger (all fingers stay in touch with surface and stay extended
2		SMALL FIST Flex the PIP and DIP joint of 2nd to 5th fingers and MCP joints remain straight
3		LATERAL PINCH Touch the tip of thumb the index finger in the area of PIP
4		HOUSETOP POSITION Flex the MCP of the 2nd to 5th finger. The DIP and PIP joint of the fingers remain straight

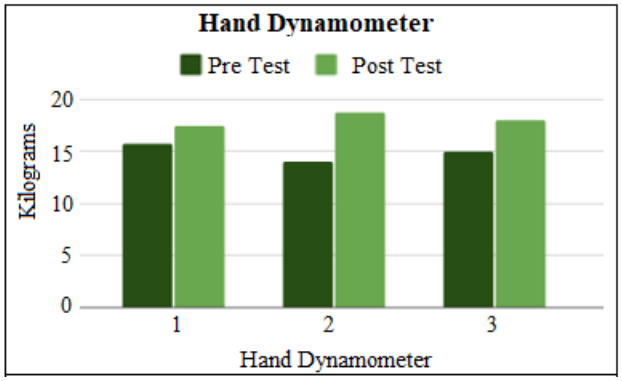
5. Result

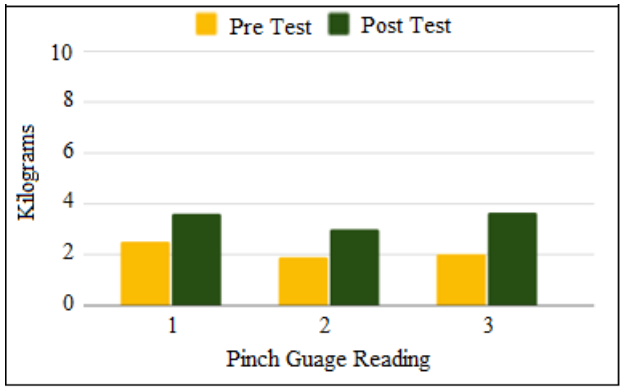
An increment in score was observed across all five outcomes. We observed an average increment of 25% in values between pre and post training assessment. The Stockholm workshop scale scores of the patient during the pre-training assessment indicated a vascular stage of 2 and a sensori- neuro score of 2SN. The range of motion (ROM) observed pre- and post-treatment for the metacarpophalangeal joint was 40 degrees in flexion before treatment and 60 degrees after treatment. For the proximal phalangeal joint, the pre-training ROM was 30

degrees and 55 degrees post-training. For the distal phalangeal joint, the ROM was 25 degrees pre-training and 40 degrees post-training. The DASH score of 37.7, assessed before the training, indicated a higher level of disability and difficulty in performing basic hand functions. The post training assessment showed an improvement, with the DASH score reducing to 27.5.

Table 3: Outcomes Measure Reading

Outcomes	Pretest score	Post test score
1.Stockholm Workshop scales		
Vascular score	Stage 2	Stage 1
Senior neuro	2SN	0SN
2.ROM (Index finger) Left hand		
Metacarpophalangeal joint	40 Degrees	60 Degrees
Proximal phalangeal	30 Degrees	55 Degrees
Distal phalangeal	25 Degrees	40 Degrees
3.Hand dynamometer		
1	15.8 kg	17.5kg
2	14.0 kg	18.8kg
3	15kg	18kg
4.Pinch gauge		
1	2.5kg	3.59kg
2	1.89kg	3.00kg
3	2.kg	3.65kg
5.DASH disability score	37.7	27.5





6. Discussion

The results of this experiment provide evidence that hand exercises and sensory reduction facilitate neurosensory stimulation and have beneficial effects in improving hand function among individuals suffering from Raynaud's phenomenon. The most notable findings of the study were: 1. Subjects with Raynaud's phenomenon have sensory issues. 2. Contributing factors such as sensorineural and vascular effects impact the hand function of subjects. The myofascial release technique, Thera Putty exercises, and active range of motion (ROM) exercises help increase circulation in the digits of the hand, which facilitates improvement in hand function. The results of this case study are interesting in several aspects. There were five outcomes measured before and after treatment, and the overall scores increased following therapy sessions, indicating an improvement in the patient's ability to complete sequential activities.

7. Conclusion

The result of this study suggested that 4 weeks of comprehensive hand rehabilitation with occupational goal-oriented exercise had a positive effect on participant strength in hand. However, limitations should be mentioned. This was a pilot trial done on a single case, the results of which cannot be generalized therefore further studies can be carried out on more subjects.

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