

Reference

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Effects of Therapeutic Interventions on Physical and Respiratory Functionality in Female Fibromyalgia Patients: A Cross-Over Study

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Products

Exopulse Mollii Suit vs. strength training and high-intensity interval training

Major Findings

With EXOPULSE Mollii Suit or exercise program:

→ **Significant performance improvement in the number of stand-ups in 30 seconds (chair stand test)**

- Significantly increased number of stand ups over all sessions for both treatments

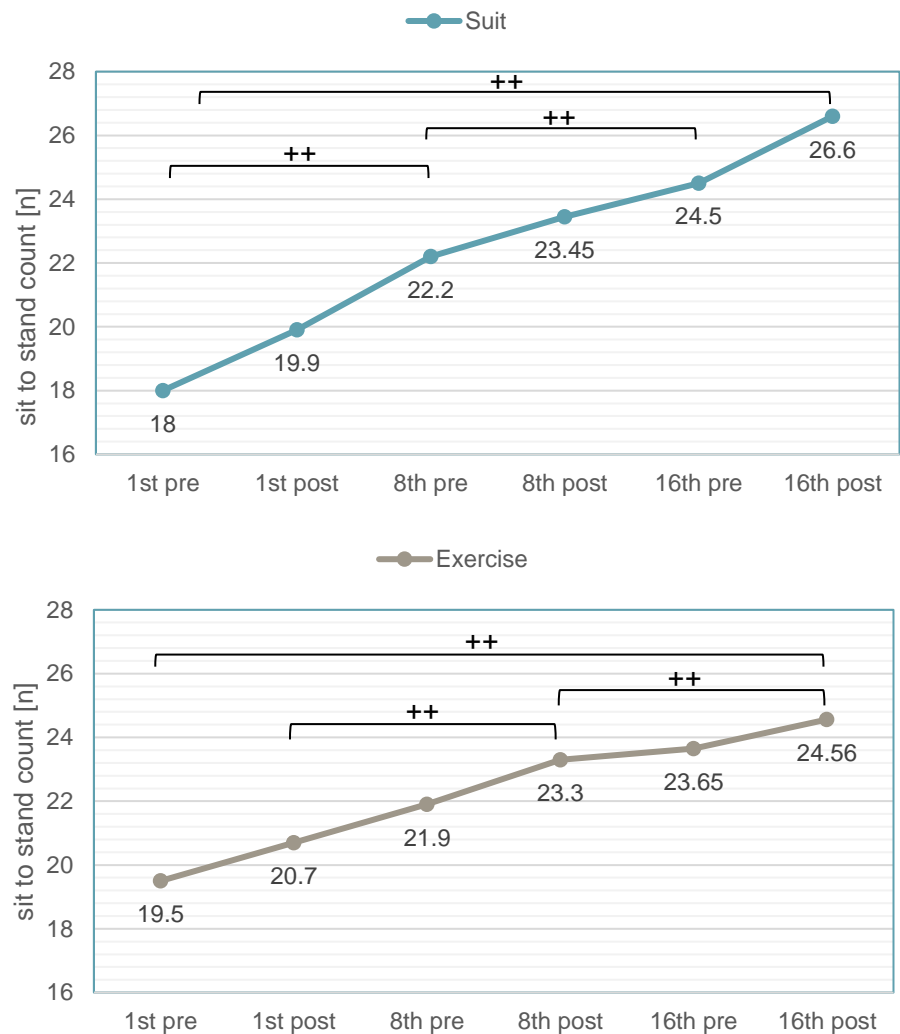
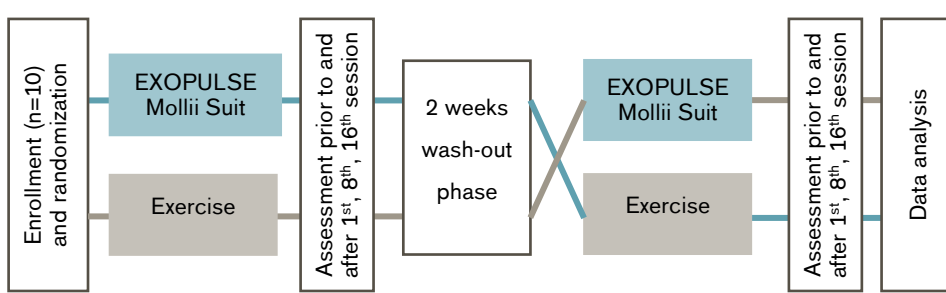


Figure 1: Counts for the Chair stand Test in [A] for the Suit and in[B] for the Exercise. Significant differences between measurement dates are marked with ++

Population	Subjects:	10 female patients
	Etiology:	Fibromyalgia (at least three months); walk independently without assistive devices; no neuromodulation therapy or structured exercise programs in the past six months
	Mean age:	51.6 ± 7.18 years
	Mean weight:	68.5 ± 8.26 kilograms
	Mean height:	160 ± 3.8 centimeters

Study Design Crossover, randomized, controlled trial:



Outcome measures were assessed before and after the interventions at the 1st, 8th, and 16th treatment sessions for each intervention (2 treatments per week for 8 weeks).

Results

Body Function & Structure					Activity			Participation	Environment
Pain	Spasticity	Physiological function	Psychological function	General Health	Activity	Mobility & Safety	ADLs	Preference, Satisfaction, QoL	Health Economics

Category	Outcomes	Results for pre-intervention vs. post-intervention <i>(expressed as means ± SD for quantitative variables)</i>	Sig.*		
Physiological function	forced expiratory volume in 1 second (FEV1) [L]	Suit			
		session	pre	post	Sig.
		1 st	2.34 ± 0.52	2.28 ± 0.44	0
		8 th	2.35 ± 0.46	2.35 ± 0.55	0
		16 th	2.36 ± 0.52	2.43 ± 0.50	0
		significant difference with large effect comparing 1 st post vs. 16 th post session (d=-0.85)			--
		Exercise			
		session	pre	post	Sig.
		1 st	2.37 ± 0.49	2.46 ± 0.56	++
		8 th	2.38 ± 0.48	2.35 ± 0.46	0
16 th	2.36 ± 0.53	2.27 ± 0.49	0		
FEV1 [%]	Suit	session	pre	post	Sig.
		1 st	93.33 ± 12.12	91.56 ± 9.98	0
		8 th	96.30 ± 11.81	95.70 ± 15.66	0
		16 th	96.60 ± 12.44	99.30 ± 10.91	0

Category	Outcomes	Results for pre-intervention vs. post-intervention (expressed as means \pm SD for quantitative variables)	Sig.*
		significant difference with large effect comparing 1 st post vs. 16 th post session (d=-0.902)	++
		Exercise	
		session	Sig.
		pre	
		post	
		1 st	++
		8 th	0
		16 th	0
		Suit	
		session	Sig.
		pre	
		post	
		1 st	0
		8 th	0
		16 th	0
	forced expiratory volume in 6 second (FEV6) [L]	Exercise	
		session	Sig.
		pre	
		post	
		1 st	0
		8 th	0
		16 th	0
		Suit	
		session	Sig.
		pre	
		post	
		1 st	0
		8 th	0
		16 th	0
	FEV6 [%]	Exercise	
		session	Sig.
		pre	
		post	
		1 st	0
		8 th	0
		16 th	0
		Suit	
		session	Sig.
		pre	
		post	
		1 st	0
		8 th	0
		16 th	0
	Ratio FEV1/FEV6 [n]	Exercise	
		session	Sig.
		pre	
		post	
		1 st	0
		8 th	0
		16 th	++
		Suit	
		session	Sig.
		pre	
		post	
		1 st	0
		8 th	0
		16 th	++
		significant difference with large effect	
		- 1 st post vs. 8 th post (d=-0.834)	++
		- 1 st post vs. 16 th post (d=-1.01)	--
		Exercise	
		session	Sig.
		pre	
		post	
		1 st	0
		8 th	0
		16 th	--
		Suit	
		session	Sig.
		pre	
		post	
		1 st pre vs. 8 th pre (d=-0.839)	--
		- 8 th pre vs. 16 th post (d=1)	++
	Ratio FEV1/FEV6 [%]	Exercise	
		session	Sig.
		pre	
		post	
		1 st	0
		8 th	0
		16 th	--
		Suit	
		session	Sig.
		pre	
		post	
		1 st	0
		8 th	0
		16 th	--

Category	Outcomes	Results for pre-intervention vs. post-intervention <i>(expressed as means ± SD for quantitative variables)</i>	Sig.*																
		<table border="1"> <tr> <td>1st</td> <td>107.44 ± 6.84</td> <td>106.11 ± 7.36</td> <td>0</td> </tr> <tr> <td>8th</td> <td>109.40 ± 8.67</td> <td>109.30 ± 4.11</td> <td>0</td> </tr> <tr> <td>16th</td> <td>109.00 ± 5.10</td> <td>110.20 ± 5.65</td> <td>++</td> </tr> </table>	1 st	107.44 ± 6.84	106.11 ± 7.36	0	8 th	109.40 ± 8.67	109.30 ± 4.11	0	16 th	109.00 ± 5.10	110.20 ± 5.65	++					
1 st	107.44 ± 6.84	106.11 ± 7.36	0																
8 th	109.40 ± 8.67	109.30 ± 4.11	0																
16 th	109.00 ± 5.10	110.20 ± 5.65	++																
		significant difference with large effect - 1 st post vs. 8 th post (d=-0.816) -- - 1 st post vs. 16 th post (d=-0.934) --																	
	Exercise	<table border="1"> <tr> <th>session</th> <th>pre</th> <th>post</th> <th>Sig.</th> </tr> <tr> <td>1st</td> <td>109.30 ± 6.38</td> <td>110.30 ± 4.81</td> <td>0</td> </tr> <tr> <td>8th</td> <td>111.40 ± 4.86</td> <td>109.40 ± 6.93</td> <td>0</td> </tr> <tr> <td>16th</td> <td>108.78 ± 7.79</td> <td>106.00 ± 9.14</td> <td>--</td> </tr> </table>	session	pre	post	Sig.	1 st	109.30 ± 6.38	110.30 ± 4.81	0	8 th	111.40 ± 4.86	109.40 ± 6.93	0	16 th	108.78 ± 7.79	106.00 ± 9.14	--	
session	pre	post	Sig.																
1 st	109.30 ± 6.38	110.30 ± 4.81	0																
8 th	111.40 ± 4.86	109.40 ± 6.93	0																
16 th	108.78 ± 7.79	106.00 ± 9.14	--																
		significant difference with large effect - 8 th pre vs. 16 th post (d= 0.998) ++																	
Activity	Chest perimeter difference [cm]	Suit																	
		<table border="1"> <tr> <th>session</th> <th>pre</th> <th>post</th> <th>Sig.</th> </tr> <tr> <td>1st</td> <td>7.62 ± 1.92</td> <td>7.98 ± 1.79</td> <td>0</td> </tr> <tr> <td>8th</td> <td>7.60 ± 2.46</td> <td>7.77 ± 2.52</td> <td>0</td> </tr> <tr> <td>16th</td> <td>8.80 ± 1.93</td> <td>9.40 ± 2.33</td> <td>0</td> </tr> </table>	session	pre	post	Sig.	1 st	7.62 ± 1.92	7.98 ± 1.79	0	8 th	7.60 ± 2.46	7.77 ± 2.52	0	16 th	8.80 ± 1.93	9.40 ± 2.33	0	
session	pre	post	Sig.																
1 st	7.62 ± 1.92	7.98 ± 1.79	0																
8 th	7.60 ± 2.46	7.77 ± 2.52	0																
16 th	8.80 ± 1.93	9.40 ± 2.33	0																
		- significant difference comparing 8 th pre to 16 th post session with large effect (d= 0.86) --																	
	Exercise	<table border="1"> <tr> <th>session</th> <th>pre</th> <th>post</th> <th>Sig.</th> </tr> <tr> <td>1st</td> <td>7.20 ± 1.75</td> <td>7.90 ± 1.91</td> <td>0</td> </tr> <tr> <td>8th</td> <td>8.70 ± 1.34</td> <td>8.85 ± 1.49</td> <td>0</td> </tr> <tr> <td>16th</td> <td>7.68 ± 2.90</td> <td>8.56 ± 2.65</td> <td>0</td> </tr> </table>	session	pre	post	Sig.	1 st	7.20 ± 1.75	7.90 ± 1.91	0	8 th	8.70 ± 1.34	8.85 ± 1.49	0	16 th	7.68 ± 2.90	8.56 ± 2.65	0	
session	pre	post	Sig.																
1 st	7.20 ± 1.75	7.90 ± 1.91	0																
8 th	8.70 ± 1.34	8.85 ± 1.49	0																
16 th	7.68 ± 2.90	8.56 ± 2.65	0																
		significant difference with large effect - 1 st pre to 8 th pre (d= -0.789) -- - 1 st pre to 8 th post (d= -1.28) -- - 1 st pre to 16 th post (d= -1.03) --																	
	Handgrip strength test [kg]	Suit																	
		<table border="1"> <tr> <th>session</th> <th>pre</th> <th>post</th> <th>Sig.</th> </tr> <tr> <td>1st</td> <td>24.07 ± 4.59</td> <td>23.62 ± 4.64</td> <td>0</td> </tr> <tr> <td>8th</td> <td>24.28 ± 3.58</td> <td>25.47 ± 3.99</td> <td>++</td> </tr> <tr> <td>16th</td> <td>23.38 ± 5.70</td> <td>24.33 ± 5.28</td> <td>0</td> </tr> </table>	session	pre	post	Sig.	1 st	24.07 ± 4.59	23.62 ± 4.64	0	8 th	24.28 ± 3.58	25.47 ± 3.99	++	16 th	23.38 ± 5.70	24.33 ± 5.28	0	
session	pre	post	Sig.																
1 st	24.07 ± 4.59	23.62 ± 4.64	0																
8 th	24.28 ± 3.58	25.47 ± 3.99	++																
16 th	23.38 ± 5.70	24.33 ± 5.28	0																
		significant difference comparing 1 st pre to 8 th post session with large effect (d= -0.848) --																	
	Exercise	<table border="1"> <tr> <th>session</th> <th>pre</th> <th>post</th> <th>Sig.</th> </tr> <tr> <td>1st</td> <td>23.64 ± 4.65</td> <td>24.45 ± 2.95</td> <td>0</td> </tr> <tr> <td>8th</td> <td>23.55 ± 4.24</td> <td>24.41 ± 3.75</td> <td>0</td> </tr> <tr> <td>16th</td> <td>24.24 ± 1.92</td> <td>24.72 ± 2.29</td> <td>0</td> </tr> </table>	session	pre	post	Sig.	1 st	23.64 ± 4.65	24.45 ± 2.95	0	8 th	23.55 ± 4.24	24.41 ± 3.75	0	16 th	24.24 ± 1.92	24.72 ± 2.29	0	
session	pre	post	Sig.																
1 st	23.64 ± 4.65	24.45 ± 2.95	0																
8 th	23.55 ± 4.24	24.41 ± 3.75	0																
16 th	24.24 ± 1.92	24.72 ± 2.29	0																
	Chair stand test [n]	Suit																	
		<table border="1"> <tr> <th>session</th> <th>pre</th> <th>post</th> <th>Sig.</th> </tr> <tr> <td>1st</td> <td>18.00 ± 8.46</td> <td>19.90 ± 9.18</td> <td>0</td> </tr> </table>	session	pre	post	Sig.	1 st	18.00 ± 8.46	19.90 ± 9.18	0									
session	pre	post	Sig.																
1 st	18.00 ± 8.46	19.90 ± 9.18	0																

Category	Outcomes	Results for pre-intervention vs. post-intervention <i>(expressed as means ± SD for quantitative variables)</i>		Sig.*	
		8 th	22.20 ± 9.08	23.45 ± 9.16	0
		16 th	24.50 ± 9.35	26.60 ± 10.44	++
		significant difference with large effects comparing the following			
		-	1 st pre vs. 8 th pre (d=-0.97)		--
		-	8 th pre vs. 16 th pre (d=-0.889)		--
		-	1 st pre vs. 16 th pre (d=-0.945)		--
		-	1 st post vs. 8 th post (d=-0.863)		--
		-	8 th post vs. 16 th post (d=-1.48)		--
		-	1 st post vs. 16 th post (d=-1.28)		--
		-	1 st pre vs. 8 th post (d= -1.1)		--
		-	1 st pre vs. 16 th post (d=-1.38)		--
		-	8 th pre vs. 16 th post (d=-1.47)		--
	Exercise	session	pre	post	Sig.
		1 st	19.50 ± 8.87	20.70 ± 10.76	0
		8 th	21.90 ± 8.36	23.30 ± 9.02	0
		16 th	23.56 ± 8.97	24.56 ± 9.98	0
		significant difference with large effects comparing the following			
		-	1 st pre vs. 16 th pre (d=-1.35)		--
		-	1 st post vs. 16 th post (d=-1.06)		--
		-	1 st pre vs. 8 th post (d=-1.1)		--
		-	1 st pre vs. 8 th post (d=-1.28)		--
		-	1 st pre vs. 16 th post (d=-1.36)		--
10 m timed up and go (TUG)test [s]	Suit	session	pre	post	Sig.
		1 st	6.06 ± 1.85	5.66 ± 1.41	++
		8 th	5.45 ± 1.29	5.31 ± 1.27	0
		16 th	5.43 ± 1.20	5.40 ± 0.97	0
		significant differences with large effects			
		-	1 st pre vs. 8 th pre (d=1)		++
		-	1 st pre vs. 8 th post (d=1)		++
	Exercise	session	pre	post	Sig.
		1 st	5.45 ± 1.19	5.32 ± 1.32	0
		8 th	5.15 ± 1.22	5.05 ± 1.07	0
		16 th	5.20 ± 0.87	4.97 ± 0.85	0
		significant difference comparing 1 st pre vs. 16 th post with large effects (d=0.867)			++
One leg balance right [s]	Suit	session	pre	post	Sig.
		1 st	45.50 ± 37.85	42.46 ± 21.84	0
		8 th	62.45 ± 36.31	72.52 ± 59.97	0
		16 th	88.60 ± 72.19	94.63 ± 77.76	0
	Exercise	session	pre	post	Sig.

Category	Outcomes	Results for pre-intervention vs. post-intervention <i>(expressed as means ± SD for quantitative variables)</i>			Sig.*
		1 st	71.47 ± 51.97	78.54 ± 57.38	0
		8 th	91.19 ± 92.53	71.69 ± 56.66	0
		16 th	57.80 ± 48.26	64.26 ± 37.11	0
One leg balance left [s]	Suit	session	pre	post	Sig.
		1 st	43.94 ± 33.49	53.54 ± 47.97	0
		8 th	59.09 ± 28.84	67.52 ± 55.92	0
		16 th	63.37 ± 53.37	58.91 ± 48.58	0
	Exercise	session	pre	post	Sig.
		1 st	63.51 ± 50.20	98.07 ± 91.49	0
		8 th	56.84 ± 36.52	71.03 ± 45.05	++
		16 th	74.74 ± 98.84	45.36 ± 27.95	0

^a no difference (0), positive trend (+), negative trend (-), significant (++/--), not applicable (n.a.)

^b significance set at $p < 0.05$; trends set at $0.1 > p > 0.05$

effect sizes calculated using Cohen's d with large ($d > 0.80$) effect size

Author's Conclusion

"We can conclude that Neuromodulation and Exercise Interventions have the potential to enhance the functionality of Fibromyalgia patients as shown by the increase in FEV1/FEV6 ratio in respiratory functionality as well as the increase in FEV 1 and chest perimeter references, and physical functionality shown by the increase in performance in the Chair stand test, 10m up and go test and balance in the right leg." (Rubio-Zarapuz et al., 2024)

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