The effects of a 12-week strength training program on skeletal muscle impairments and physical limitations in men with myotonic dystrophy type 1

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INTRODUCTION

Myotonic dystrophy type 1 (DM1) is a genetic multisystemic degenerative disease caused by an abnormal repetition of CTG triplets on the DMPK gene and represents the most prevalent myopathy in adults. Skeletal muscles are particularly affected, as demonstrated by muscle weakness and atrophy experienced by affected people, which limit their social participation.[1] Strength training has been shown to be safe in this population.[2] **The aim of this project is to determine the effects of a 12-week strength training program on skeletal muscle impairments and physical limitations in men with DM1**.

METHODS

In this before-after study, a 12-week strength training program (twice a week) of 6 to 8 maximal repetitions (RM) of five different lower limb exercises (Figure 1) was completed by 11 men with DM1. Participants had to be males between 30 and 65 years old, with the adult form of DM1 without any contraindications to strenuous physical exercise such as severe cardiac or respiratory impairments. The evaluation included: 10 meter walk test (comfortable and maximal speed), 30 second sit-to-stand test, a modified timed stair test, quantitative muscle strength assessment of knee extensors muscle group, 1-RM test for all exercises and an interview about perceived changes (Table 1).

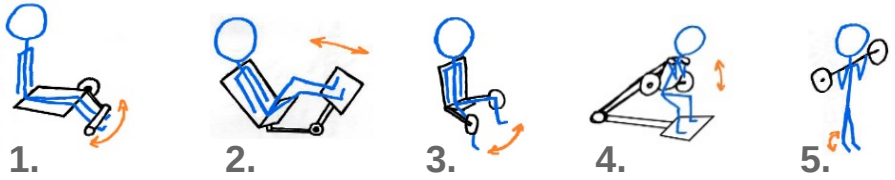

Figure 1: Training program exercises. 1. Leg extension, 2. Leg press, 3. Hip abduction, 4. Squat and 5. Plantar flexion.

Table 1: Evaluations and measurements time table

	Week 0	Week 6	Week 12
Maximal muscle strength			
Quantified manual testing (QMT)	X	X	X
1 RM	X	X	X
Mobility and balance			
10 meter walk test (comfortable and maximal speed)	X	X	X
30 second sit-to-stand	X	X	X
Modified timed stair test	X		X
Interviews	X		X
Anthropometric measurements	X		X

RESULTS

Table 2: Patient characteristics

Subject #	Age (years)	Weight (kg)	CTG repeats (n)
523	59	69.6	80
907	60	70.7	400
1242	54	66.5	1200
1791	48	71.2	250
1806	41	109.9	400
1955	61	76.6	65
2002	32	114.8	250
2005	61	99.0	80
2019	51	92.7	70
2110	35	70.1	80
2182	37	61.4	350
Average (SD)	49 (11)	82.0 (18.7)	293 (330)

Results

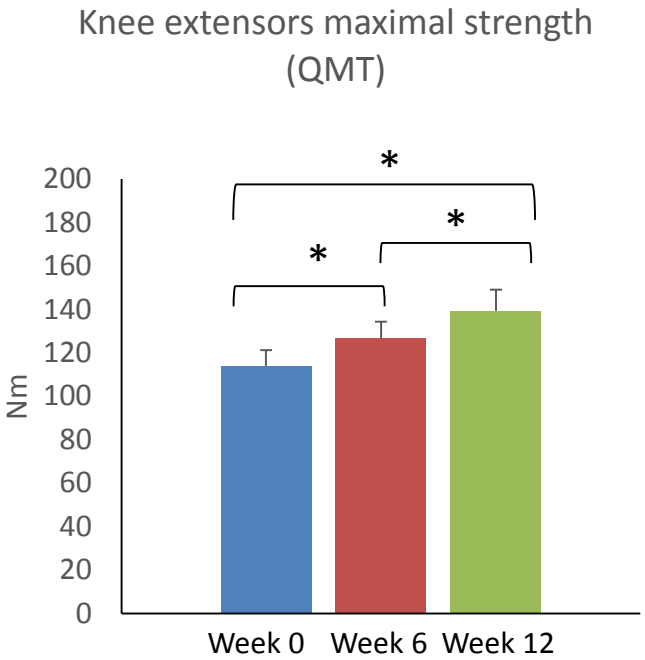

Figure 2: **Knee extensor maximal strength (QMT)**, mean values of left and right lower limbs for all participants. Maximal strength significantly improved between weeks 0 to 6, 6 to 12, and 0 to 12. * $p < 0.05$

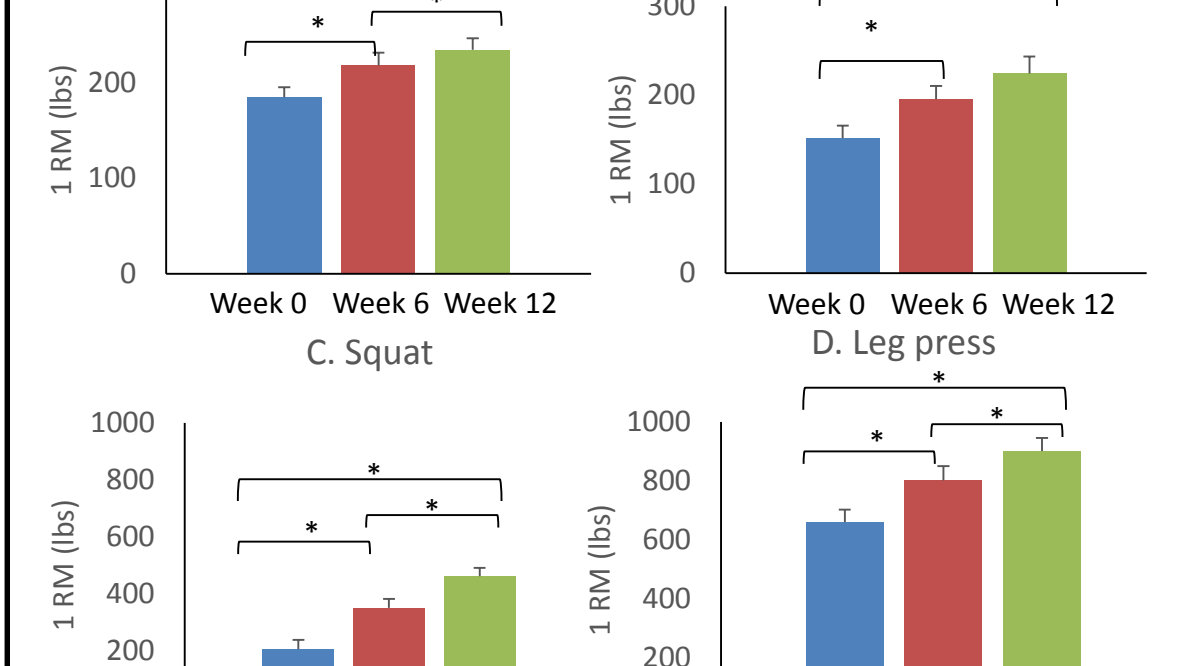

Figure 3, A to D: **1 RM values** for all exercises of the training program excluding plantar flexion. A, C and D. Maximal strength significantly improved between weeks 0 to 6, 6 to 12, and 0 to 12. B. Maximal strength significantly improved between weeks 0 to 6 and 0 to 12. * $p < 0.05$

Results

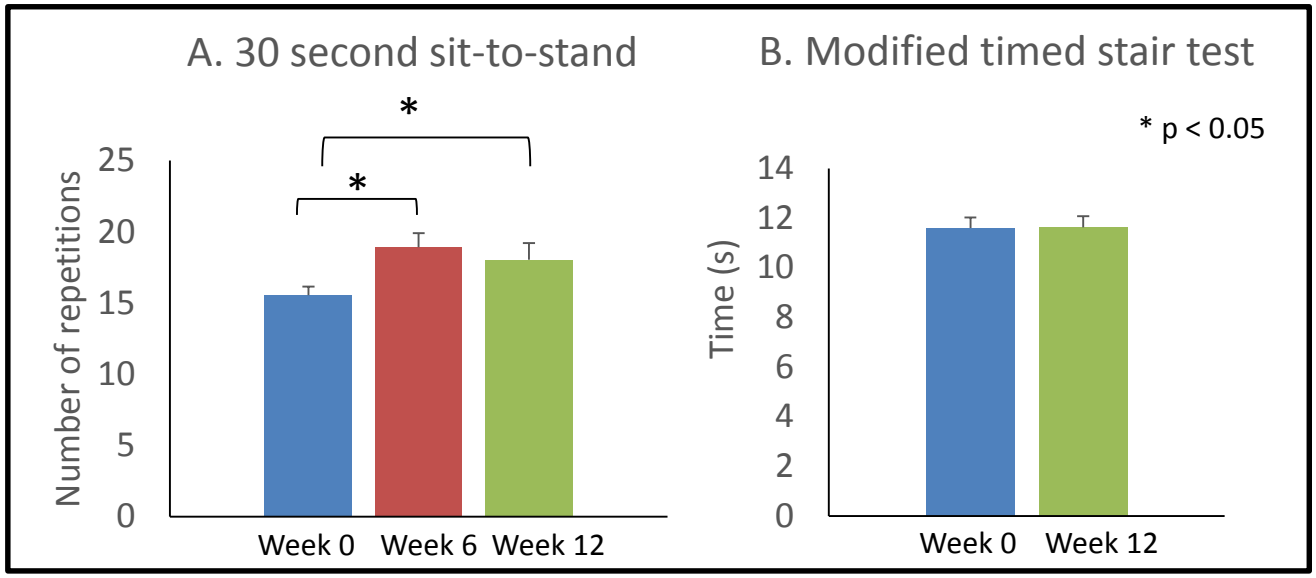

Figure 4 A and B: **Functional tests**. A. 30 second sit-to-stand, repetitions significantly improved between weeks 0 to 6 and 0 to 12. B. There was no significant change in the time to complete the modified timed stair test.
* p < 0.05

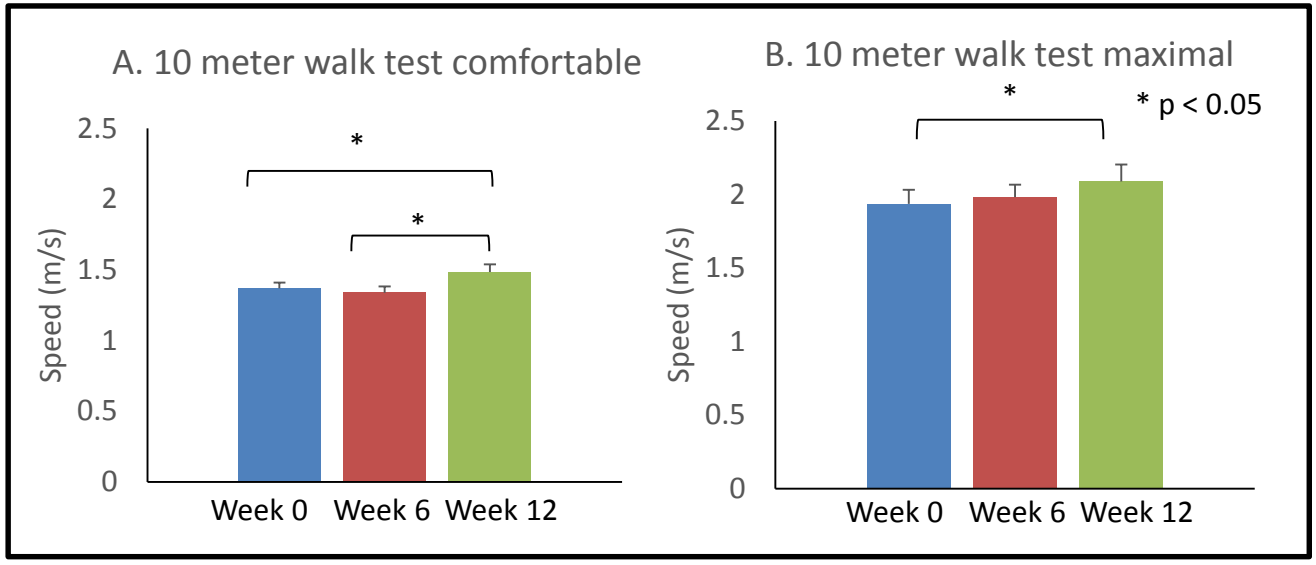

Figure 5 A and B: **10 meter walk tests.** A. Comfortable walking speed significantly improved between weeks 6 to 12 and 0 to 12. B. Maximal walking speed significantly improved between week 0 to 12. * p < 0.05

Results

Table 3:

Most self reported changes and advantages	Participants who reported the changes
Stronger lower limbs (n=7)	907, 1242, 1806, 1955, 2002, 2005 and 2110
Feels in better physical shape (n=5)	523, 1791, 2002, 2005 and 2019
More energy/less fatigue (n=5)	1242, 2002, 2005, 2110 and 2182
Better mood (n=3)	523, 907 and 1242
More capacities (n=3)	523, 2002 and 2110
Is able to walk more (n=3)	523, 1791 and 2019
Stairs are easier (n=3)	1242, 2019 and 2182

Presented self reported changes are those that were reported more than 3 times. Other self reported changes and advantages include, but not limited to, less falls, better self confidence and feeling proud of what was accomplished during the program.

Discussion

11 men with the adult form of DM1 participated in a supervised 12-week strength training program. After the training program, participants:

- Were stronger at QTM test for knee extension
- Were stronger at 1 RM tests
- Performed better at the 30 second sit-to-stand test
- Walked faster in the 10 meter walk tests.
- Reported many benefits, the most reported were:
    - stronger lower limbs
    - better physical shape
    - more energy/less fatigue

Brady et al. had reported that habitual exercise in patients with DM1 can have positive effects en strength.[3] Our study confirms that strength training can enhance strength and helps precise which parameters can be used to achieve this.

This is the first study using strength training as an intervention with as many DM1 participants.[2] It is to be noted that these participants were carefully selected to assure the safety of the training program: patients with severe heart or lung impairments were excluded from this study. As these impairments are frequently present in the DM1 population,[1] clinical judgement is to be used when starting a training program to ensure it is safe for the participant.

Conclusion

A standardized strength training program seems to be an efficient intervention to counter skeletal muscle weakness and improve function in people affected with the adult form of DM1. Further investigations are needed, namely at a histological level, to confirm that these adaptations are due to skeletal muscle hypertrophy.

References

1- Harper, P.S., (2001) Myotonic dystrophy
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