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Effects of self myofascial release on grip strength recovery

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Abstract

Introduction: Recovery is a key aspect in sports performance. Self myofascial release is a technique where you massage your muscles with various tools. Previous study have showed that it can improve mobility. There is a lack of scientific studies made in this area.

Aim: The aim of this study is to examine the effects of self myofascial release on maximal force in the grip after activity involving the grip until failure.

Method: Eleven subjects were tested in grip strength in the right and left arm with a grip dynamometer. After a set of exhaustive activity for the grip the subjects performed self myofascial release on one arm. Grip strength was then re-tested after 5 minutes and 24 hours.

Result: There was a significant decrease in strength following the exhaustive exercise. Subjects had regained their full strength after 24 hours of rest. Self myofascial release did not affect the recovery according to the result.

Discussion: More research need to be done. If using a similar approach as in this study the recovery time need to be shorter so that subjects do not recover their full strength. There are indications that the dominant arm recover faster than the non-dominant arm.

Bakgrund: Återhämtning är en viktig aspekt i idrottsprestationer. “Self myofascial release” är en teknik där du massera dina muskler med olika verktyg. Tidigare studier har visat att det kan förbättra rörligheten. Det finns en brist på vetenskapliga studier som gjorts på detta område.

Syfte: Syftet med denna studie är att undersöka effekterna av “self myofascial release” på maximal styrka i greppet efter aktivitet som involverar greppmuskulaturen till utmattning.

Metod: Elva försökspersoner testades i greppstyrka i den högra och vänstra armen med en greppdynamometer. Efter en utmattande aktivitet för greppet utförde deltagarna “self myofascial release” på ena armen. Greppstyrka testades därefter på nytt efter 5 minuter och 24 timmar.

Resultat: Det fanns en signifikant minskning i styrka efter den utmattande aktiviteten. Deltagarna hade återfått sin fulla styrka efter 24 timmars vila. “Self myofascial release” påverkade inte återhämtningen enligt resultatet.

Diskussion: Mer forskning behöver göras. Om man använder en liknande metod som i denna studie bör återhämtningstiden vara kortare så att deltagarna inte återfår sin fulla styrka. Det finns indikationer på att den dominanta armen återhämtar sig snabbare än den ickedominanta armen.

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Introduction

Recovery is a key aspect in the development of an athlete. Together with training and nutrition an optimal recovery decides how well the athlete improve his or her physical capacity. If sufficient recovery is neglected, it can create a state of overtraining which can be very devastating for the athlete. Physiological signs and symptoms for overtraining include higher resting heart rate, changes in normal blood pressure, elevated basal metabolic rate and weight loss to name a few (Johnson, & Thiese, 1992).

In their review, Bishop et al (2008) talks about different time aspects related to recovery. According to the authors recovery is divided in three categories depending on the duration: recovery between muscle exertions, recovery between sets and recovery between training sessions. The review is made on literature examining recovery between training sessions. One section in their review covers methods that may lead to better recovery. These methods include: active- versus passive rest, diet and ergogenics, rehydration, massage therapy, analgesics, cryotherapy and combined treatments. The section about massage therapy is relevant for this study and the review suggest that it does not speed recovery but have shown to reduce delayed onset muscle soreness. The reviewed studies about massage did not use any tool measuring maximal strength to record recovery.

Delextrat et al. (2014) writes about how well recovered basketball players were after a competitive match divided in three groups: massage, massage with stretch and no treatment. Variables included in that experiment were perception of fatigue and soreness, countermovement jump and repeated sprint ability. The results showed significant improvements in the two test groups compared to control.

To measure recovery you can use a variety of methods. These can be physiological measurements and subjectively perceived recovery on a scale from one to ten (Laurent, Green, Bishop, Sjökvist, Schumacker, Richardson, & Curtner-Smith, 2011) or both. Physiological measurements may be done on blood lactate and heart rate as well as peak and mean power using a Wingate test on a cycle ergometer (Robertson, Watt, & Galloway, 2004). These are all rather objective measurements though peak and mean power can be biased by the motivation of the subjects.

In one study about recovery (Leyk, Rohde, Erley, Gorges, Wunderlich, Rüther, & Essfeld, 2006) three different parameters related to grip were used in purpose to examine recovery from carrying a stretcher until it slipped out of their hands. The methods used to measure recovery were peak force, mean force over 15 s and a hand-steadiness test.

In their study Laurent et al (2011) shows that the perceived recovery status (PRS) scale is a good way to monitor recovery. It is a ten grade scale that is subjectively used to rate recovery and has been shown accurate. Although accurate it is a more subjective than objective way to determine recovery.

When doing exercise to exhaustion the recovery time may vary depending on the type of activity. The study where the subjects were carrying a stretcher the work of the grip was isometric. With this type of activity the grip strength was not fully recovered after 48 hours (Leyk, Rohde, Erley, Gorges, Wunderlich, Rüther, & Essfeld, 2006).

One study from 2010 looked at active recovery and its effect on hand grip strength among climbers (Green, & Stannard, 2010). Two different methods for active recovery of the grip muscles were used: hand shaking and holding a vibrating grip device. The results showed that none of the two methods did significantly improve performance compared to passive rest. Tests used were MVC and a 20-repetition time trial with a grip trainer. Exhaustion of the grip was made with a spring grip trainer.
In the study mentioned earlier (Leyk, Rohde, Erley, Gorges, Wunderlich, Rüther, & Essfeld, 2006) where the subjects were carrying a stretcher peak force for the grip and mean force over 15 s was measured. Complementing this was a test of hand steadiness and the aim was to examine the recovery for each variable. Post-test of maximal force showed a reduction of 20% after carrying the stretcher and after 24 hours the value was 12% lower than the pre-test.

Self myofascial release is a technique where you are doing manual therapy on your muscle fascia with the help of various tools. According to one study (Healey, Hatfield, Blanpied, Dorfman, & Riebe, 2014) the usage of this method have been increasing over the last years. It is explained that despite the popularity there is lacking scientific research in the area. Their study aimed to show any effects of foam rolling (myofascial release) on performance. Various exercises of foam rolling were compared with similar positions held for 30 seconds without the use of a foam roller. Performance tests included measurements of vertical jump, isometric strength and an agility test. There was no significant increase in performance with foam rolling compared to the isometric planking. Further studies on SMR have been shown to decrease arterial stiffness and endothelial function (Okamoto, Masuhara, & Ikuta, 2014). This study did not use any measurements on performance. Another study on SMR examined the effects of two one minute treatments on the quadriceps with the help of a foam roller (MacDonald, Penney, Mullaley, Cuconato, Drake, Behm, & Button, 2013). The result showed an increase in range of motion without any decrease of muscle performance.

Aim

This study intends to widen the knowledge about fascial release and in what way it may be beneficial in terms of recovery. Previous research has not specifically looked at fascial release as a recovery method. Recovery is a very central aspect of sport performance and the lack from it may lead to performance decline and/or overtraining and that makes the aim of this study to examine the recovery effects of self myofascial release on maximal force in the grip after activity involving the grip until failure.

The research questions for this study are:

How much is the strength loss from hanging in a pull-up bar until exhaustion in the dominant- and non-dominant arm?

How does the grip strength recover due to time (short- and long term)?

How does the grip strength recover due to self myofascial release?

What practical applications can be made from the result?

Method

Experimental approach to the problem

Measurements of maximal hand grip strength were used to examine the effects of one 5-minute- and three 10-minute treatments of self myofascial release within 24 hours. Times for treatment were not based on any previous science but rather for practical reasons. The hand grip testing was made with a Vetek hand dynamometer EH101. The maximal limit for the dynamometer was 90 kilograms with 0.1 kilograms precision. The handle of the grip device was adjustable and screwed to its max level in order to make the measurements comparable. Each subject used one arm as control and the other arm as test arm for the experiment. Six subjects used their dominant arm as test arm and five subjects used their non-dominant arm as test arm.

Subjects

The subjects were eleven male athletes from Sweden competing in cross-country skiing. All of them were voluntarily participating in the study and were informed about the risk of doing so. Mean ± SD for their age, weight and height were 17.5 ± 1.0, 72.2 kg ± 9.3 kg, 178.7 cm ± 5.7 cm.

Test procedures

Table 1. Visually explanation of the test procedure:

Part 1: Performed under supervision.					**Part 2: Performed without supervision within 24h following the part 1.**	**Part 3: Performed under supervision 24h after measurement two.**
Strength measurement on right and left arm.	Exhaustive exercise.	Strength measurement on right and left arm.	5 minute myofascial release with golf ball.	Strength measurement on right and left arm.	3 sessions of myofascial release. 10 minutes each.	Strength measurement on right and left arm.

Prior to the study ten measurements on each arm were made on ten persons and showed a mean ± SD of 48.79 kg ± 2.74 for the right arm and 47.27 kg ± 2.23 for the left arm. These two hundred measurements were made on male subjects with ages 18-50 and show how the values vary when doing repeated measurements on one person. Tests of the dynamometer with a 25 kg Eleiko weight plate showed exactly 25 kg which indicate that it is accurate.

Maximal grip force was measured four times on each arm of every subject during a 24 hour period. During the test the subjects were standing straight with the arms hanging straight down. In that position the hand grip dynamometer measurement was made without compromising posture. Subjects did in total three measurements on every occasion for each arm when strength was measured.

Following the first measurement of grip strength the subjects did two sets of exhaustive exercise which consisted of a dead hang from a pull-up bar. The bar was coated with a folded towel to make the exercise more demanding to the grip in terms of friction. Subjects were doing the dead hang with a thumbless grip to ensure that hook grip was not used (thumb locked by the fingers). The hang was performed until failure and the subjects were verbally encouraged to do their best and hang on as long as possible. Subjects were allowed to retake the grip as during the activity to make them hang longer and get more fatigue. After the subjects lost their grip of the bar there was a short break (about 10 seconds) and then maximal force was measured with the hand dynamometer.

Between the measurement of strength right after the dead hang and the third measurement the subjects performed one 5 minute session of SMR on the forearm using a golf ball. The rolling with the ball was performed on muscles flexing the fingers (m. flexor digitorium superficialis and m. flexor digitorium profundus) laying on the floor with the arms in front. Additional pressure on the test arm was applied with the control arm and rolling was done slowly back and forth from elbow to wrist. Every subject was given a sheet to fill in when performing the SMR. Following the first SMR session maximal grip strength was tested once again. During the 24 hours after the third strength measurement the subjects performed three 10 minute SMR sessions at home upon which the fourth measurement of strength took place.

Six subjects performed the massage on their dominant arm and five subjects on their non-dominant arm. The right arm was the dominant arm for all of the subjects.

Statistical analyses

Mean values and standard deviation was calculated and displayed in Excel were a dependent t-test was used for statistical comparisons. Alpha level was set at 0.05, reliability was calculated using the root mean square error (RMSE).

Result

All subjects reported that all four sessions of myofascial release had been performed during the 24 hour period the intervention lasted. No one got injured during the experiment and there were no other drop-outs.

In the beginning of the study a reliability test for the dynamometer was made by calculating the root mean square error (RMSE) on ten measurements on each hand performed by ten persons (P). The first table displays the strength measurement for the right hand and the second for the left hand. The variance for each person is displayed to the right. Down to the right is the RMSE is displayed. To consider anything a change using this dynamometer the change must the larger than 2.9 kg for the right arm and 2.4 kg for the left arm. (See table 2, 3).

Table 2. Displaying the strength values in the right arm from ten persons. Variance, mean variance and RMSE are displayed to the far right in the figure.

	Right hand										Variance
P1	40.8	42.4	43.9	43.6	42.5	40.9	42.9	42.1	42.1	42.6	1
P2	39.9	44.1	39.7	42.1	43.3	40.9	44.2	40.7	44.9	44.5	4.04
P3	31.9	41.1	41.3	38.8	42.1	43.4	40.9	39.2	43.2	42.4	11.28
P4	38.1	36.9	33.5	35.8	32.9	40	34.2	32.3	34.4	34	6.04
P5	62.9	65.4	64.4	63.2	67.1	61.9	63.7	63.3	61	62.1	3.19
P6	60.1	59	60.3	68	70.3	71.3	71	72.2	66.4	66.8	25.36
P7	42.5	43.4	44.2	37.8	38	44.1	46.3	46.9	44.4	44.3	9.39
P8	46.7	45.4	45	47.4	44.9	50.8	51.8	51	48	50.4	7.14
P9	55.6	56.9	54.7	56.8	55.2	54	53.7	50	48.9	50.3	8.33
P10	56.6	47.9	57.9	54.6	52.6	51.4	49.1	52	50.2	52	10.01
										Mean var.:	8.58
										RMSE:	2.93

Table 3. Displaying the strength values in the left arm from the same ten persons. Variance, mean variance and RMSE are displayed to the far right in the figure.

	Left hand										Variance
P1	46.2	46.3	40.3	38.7	37.5	39	41.3	43.3	41.2	42	8.91
P2	40.6	48.3	47.5	47.4	48.7	48.4	47.8	50.2	49.6	49.1	7.13
P3	36.4	43.2	39.3	37.5	38.2	39	35.9	40.2	36.9	41	5.14
P4	23.1	26.5	24.6	26.3	26.7	28	29.3	26	28.5	28.7	3.74
P5	63.3	63.4	61.7	58.9	62.8	61.9	59	63.1	62.2	61.2	2.7
P6	60.8	59.5	67.4	70.6	67.9	75.2	67.8	65.6	64.5	67.5	20.44
P7	45.9	40.5	39.8	40.4	40.6	41.1	41.6	39.5	39.6	40.3	3.47
P8	44	44.4	44.2	45.1	46.4	46.1	48.6	46.6	47.3	45.9	2.16
P9	56	56.8	54.9	55.4	56.9	54.5	54.8	54.2	54	53.4	1.38
P10	46.6	46.6	47.4	47.8	51.2	48.3	44.6	46	48.6	48.4	3.19
										Mean var.:	5.83
										RSME:	2.41

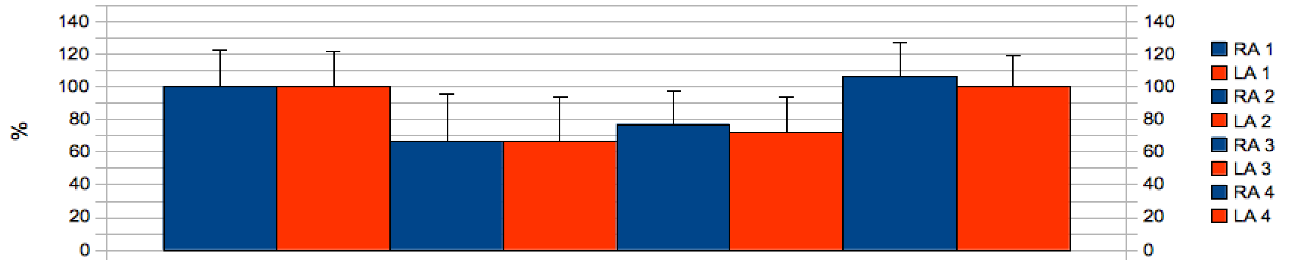

Figure 1: Displaying the mean grip strength and standard deviation of the subjects for the dominant- and non-dominant arm over time in %. Starting from the left the first two measurements (RA 1, LA 1) was made prior to exhaustion. The second two measurements (RA 2, LA 2) were made after exhaustion. The third two measurements (RA 3, LA 3) were made after 5 minutes and one SMR-treatment. The last two measurements (RA 4, LA 4) were made 24h after the second two measurements.

Strength loss

The reduction in strength following the hang from the pull-up bar was 12.3 kg (34%) ± 4.3 for the right hand and 12.4 kg (34%) ± 4.2 for the left hand.

Table 4. Mean strength values and standard deviation from the measurement before (B) and after (A) exhaustion, right and left hand put together. There was significant decrease in strength from the first measurement (M=36.7 kg, SD=8 kg) to the second measurement (M=24.4 kg, SD=6.8 kg), $p<0.05$:

Mean-B	SD-B	Mean-A	SD-A	p-value
36.7 kg	±8 kg	24.4 kg	±6.8 kg	0.00

Table 5. Mean strength values and standard deviation for right and left arm before (B) and after (A) exhaustion. There was significant decrease in strength from the first measurement to the second measurement in right and left arm, $p<0.05$:

	Mean-B	SD-B	Mean-A	SD-A	p-value
Right arm	36.7 kg	±8.2 kg	24.4 kg	±8.1 kg	0.00
Left arm	36.8 kg	±8.1 kg	24.3 kg	±6.8 kg	0.00

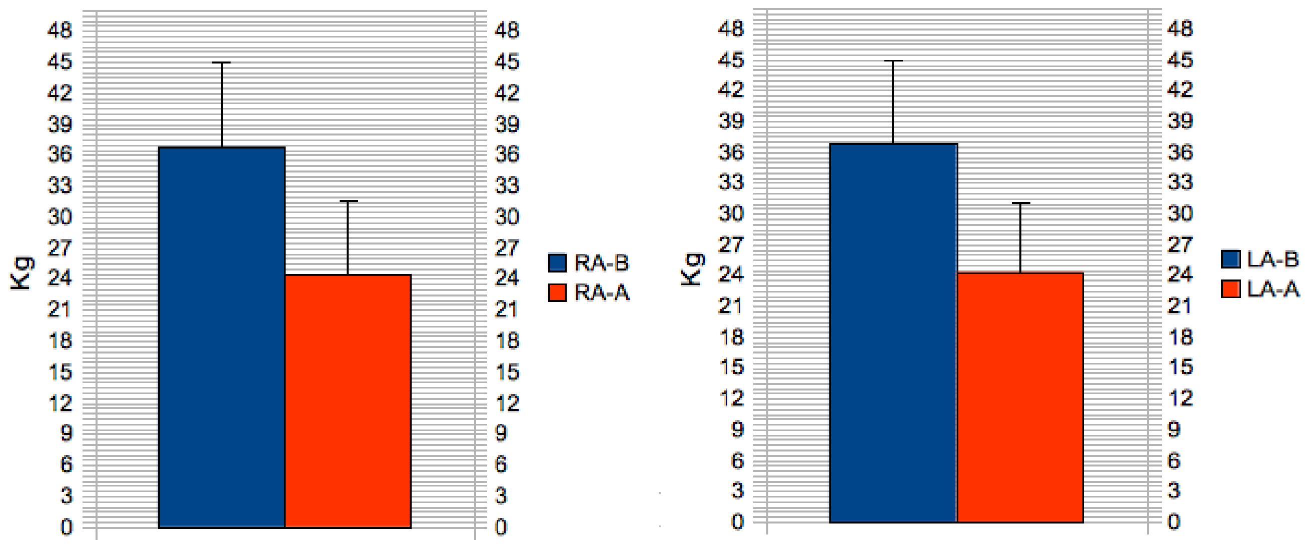

Figure 2: To the left displaying the mean strength values and standard deviation for the right arm before (RA-B) and after (RA-A) exhaustion. To the right displaying the mean strength values and standard deviation for the left arm before (LA-B) and after (LA-A) exhaustion. There was significant decrease in strength from the first measurement to the second measurement in right and left arm, $p<0.05$.

Recovery in the dominant- and non-dominant arm

Table 6. Recovery in right (R) and left (L) arm between measurement two and three. Recovery between measurement two and three were significantly higher in the right arm (M=3.8 kg, SD=3.5) compared to the left (M=2.2 kg, SD=3.6), p=0.01, though the difference was smaller than the RMSE:

Mean-R	SD-R	Mean-L	SD-L	P-value
3.8 kg	±3.5 kg	2.2 kg	±3.6 kg	0.01

Table 7. Mean values for strength recovery and standard deviation in right- (R) and left (L) arm between measurement two and four. Strength recovery between measurement two and four were significantly higher in the right arm (M=14.6 kg, SD=6.9) compared to the left arm (M=12.4 kg, SD=5.7), p=0.01, though the difference was smaller than the RMSE:

Mean-R	SD-R	Mean-L	SD-L	P-value
14.6 kg	±6.9 kg	12.4 kg	±5.7 kg	0.01

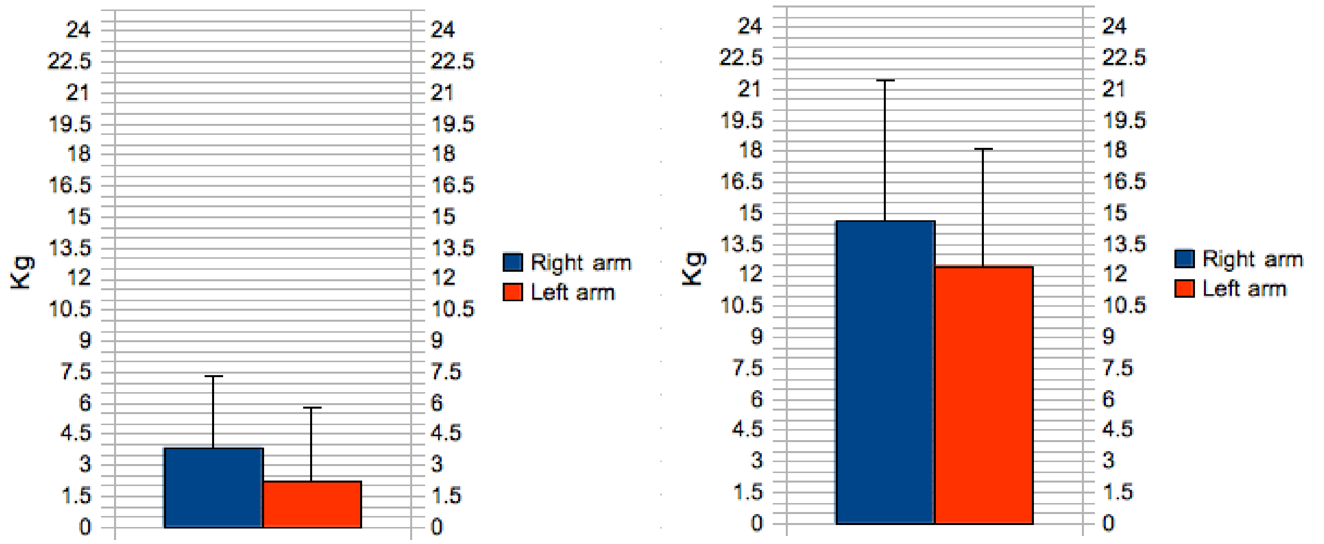

Figure 3: To the left: displaying mean strength recovery and standard deviation in right and left arm between measurement two and three. To the right: displaying mean strength recovery and standard deviation in right and left arm between measurement two and four. Recovery between measurement two and three were significantly higher in the right arm (M=3.8 kg, SD=3.5) compared to the left (M=2.2 kg, SD=3.6), p=0.01. Strength recovery between measurement two and four were significantly higher in the right arm (M=14.6 kg, SD=6.9) compared to the left arm (M=12.4 kg, SD=5.7), p=0.01.

Recovery due to self myofascial release

Table 8. Mean values for strength recovery and standard deviation in massage (M) and non-massage (NM) between measurement two and three. There was no significant difference in mean strength values for recovery from measurement two to three between the arm that received massage (M=3.2 kg, SD=3.4 kg) and the non-massage arm (M=2.8, SD=3.9), p=0.65:

Mean-M	SD-M	Mean-NM	SD-NM	P-value
3.2 kg	±3.4 kg	2.8 kg	±3.9 kg	0.65

Table 9. Mean values for strength recovery and standard deviation for massage (M) and non-massage (NM) between measurement two and four. There was no significant difference in strength between the massage arm (M=13.5 kg, SD=6.3 kg) and the non-massage arm (M=13.5 kg, SD=6.6), p=0.99:

Mean-M	SD-M	Mean-NM	SD-NM	P-value
13.5 kg	±6.3 kg	13.5 kg	±6.6 kg	0.99

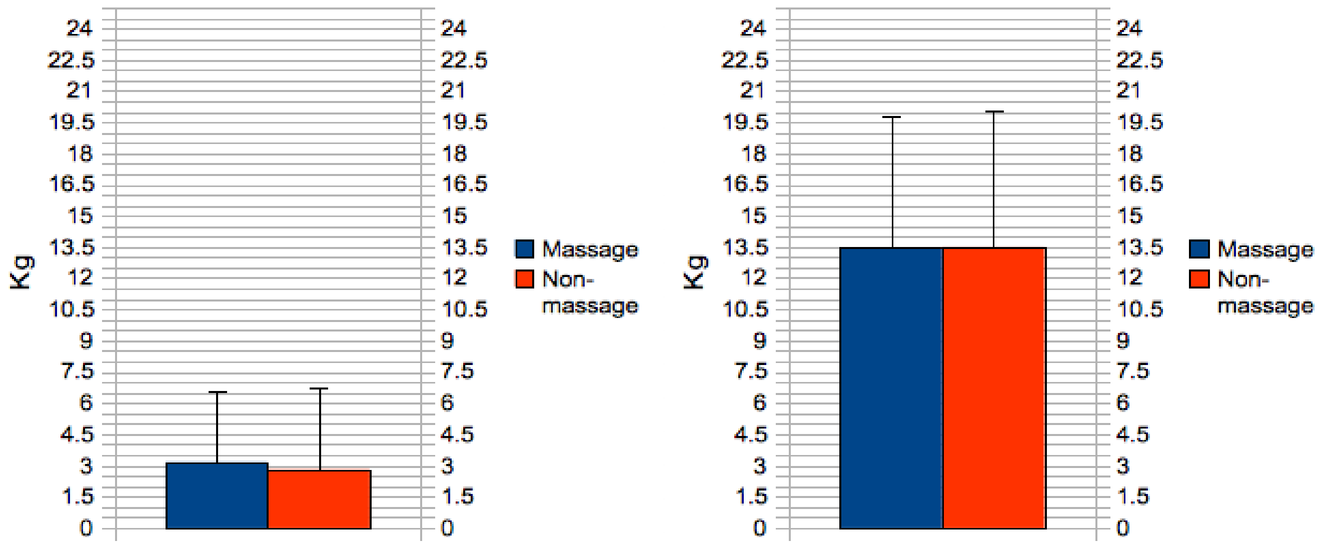

Figure 4: To the left: displaying mean strength recovery and standard deviation in the massage- and non-massage arm between measurement two and three. To the right: displaying mean strength recovery and standard deviation in the massage- and non-massage arm between measurement two and four. There was no significant difference between any of the values, p>0.05.

Table 10. Mean strength values and standard deviation in right (R) and left (L) arm for measurement four. Mean values during measurement four were higher (M=39 kg, SD=8.2 kg) than mean values during the first measurement (M=36.7 kg, SD=8.2 kg) for the right arm. Mean values for the left arm showed no difference. There was a significant difference between right (R) and left (L) arm but the difference was smaller than RMSE:

Mean-R	SD-R	Mean-L	SD-L	P-value
39 kg	±8.2 kg	36.8 kg	±6.9 kg	0.02

The RMSE from the measurements made prior to this study was 2.9 kg for the right arm and 2.4 kg for the left arm. The largest difference in recovery in these results was between the right and left arm from measurement two and four. This difference was 2.2 kg so it is in this study considered as no difference.

Discussion

To start with there is not much previous study made on myofascial release and its effects. There are some studies made about the effect of massage on recovery (Hemmings, Smith, Graydon, & Dyson, 2000) but not anything about myofascial release techniques in terms of recovery. This experiment on grip strength and recovery via myofascial release is a try to expand the knowledge in the area.

The subjects for this study were youth elite athletes competing in cross-country skiing. Compared to people that are not competing athletes the subjects in this study may have faster recovery rate. This in combination with a too long recovery period between the second and last measurement made the values return to normal. Untrained athletes may have given a more dramatic decrease in maximal strength after the exhaustive exercise and potentially higher possibility to see any differences. The exhaustive exercise could have been made more demanding with additional sets to get a larger strength loss.

The fourth measurement showing mean values similar to the first measurement the recovery time can be considered too long. If there would be a difference between the test arm and the control arm in terms of recovery, these effects would get blurred out if subjects regained their full strength in both arms. Since the long term effects disappeared a more appropriate way to do it would be to use two short term measurements. If the two recovery times were the same length the measurements would also be comparable to each other. This study showed full recovery after 24h from doing an isometric exhaustive exercise for the grip in contrast to other studies (Leyk, Rohde, Erley, Gorges, Wunderlich, Rüther, & Essfeld, 2006).

The number of subjects in this experiment was quite few. Tests on all subjects were made on the same day which in this case meant less time with each subject. If divided in smaller groups and tested on separate days a much larger group would have been possible to include.

Since the training in this study was self-reported by the subjects and not directly controlled when the training was performed there is a lack of validity. A better but less practical way to do it would be to do the myofascial release sessions together in a standardized and controlled manner at pre-decided occasions. In this way the execution of the exercise could be supervised so that everyone performed it with the same technique.

The protocol that the subjects used and filled in was not based on any previous study. Reason for this was that no previous studies have used the technique to improve recovery. It was made from common sense with main goals to be practical and easy to perform. A more extensive protocol may have shown different result but with a higher risk of subjects skipping sessions due to lack of motivation. All subjects reported that they performed every session in the protocol and that self-report is the only evidence for compliance. Since the subjects were not controlled when doing the prescribed exercise the execution may have been different between subjects. This among other things like timing relative to test and retest decrease the reliability of the tests.

In a try to measure recovery a hand dynamometer have been used in this experiment. The variable used to determine level of exhaustion and recovery with this hand dynamometer was maximal strength. Green et al (2010) used a similar device in their study were they compared two methods of recovery on climbers. In another study that used maximal grip strength as a value of recovery (Leyk, Rohde, Erley, Gorges, Wunderlich, Rüther, & Essfeld, 2006) they used a strain gauge sensor (K-2565, Lorenz Messtechnik Ltd., Alfdorf, Germany). Not using a grip strength measuring device that has been used in previous study is a clear deficiency. With the use of a more known tool for measuring grip strength the result may have been more comparable to other studies. Another dynamometer may have given other RMSE values and thereby maybe less required change in the measurements made in this study. The tool used for the intervention in this study was a golf ball. By using specialized tools for the purpose the result may have been different.

On the other hand these values indicate that the dominant side is more efficient in terms of recovery. The explanation for this is out of scope for this study but may be a result of more muscle mass, greater usage when recovering or neurological differences. Contrary to this the mean strength values and standard deviation were almost identical comparing the first measurement of strength in the right.

Conclusion

The conclusion that can be made from this study is that further research is needed. With a similar type of exhaustion as in this study the recovery time needs to be shorter. The result from this study suggests that self myofascial release is not beneficial for recovery in the grip strength following a set of exhaustive exercise consisting of an isometric hold. The practical applications from this study are that it can provide information for further study.

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Age, weight and height of subjects and strength values

Subject	Age	Weight (kg)	Height (cm)
1	18	80	185
2	19	79	178
3	18	68	174
4	19	66	174
5	19	75	181
6	17	51	168
7	17	74	183
8	17	70	177
9	17	85	186
10	17	78	186
11	17	76	180

Strength measurement 1:

Subject	Right arm (kg)	Left arm (kg)
1	48	47.7
2	49.7	45.2
3	37.8	38.6
4	36.1	32.6
5	33.1	31.5
6	25.1	26
7	34.2	36.2
8	24.2	26.3
9	36.1	37
10	44.6	50.2
11	34.9	33.2

Strength measurement 2:

Subject	Right arm (kg)	Left arm (kg)
1	40.2	35.7
2	31.5	31.4
3	24.6	28.1
4	23	20.8
5	23.5	19.3
6	18.2	17.1
7	19.4	18
8	12.4	14.6
9	24.9	25.2
10	24.1	29.5
11	26.3	28

Strength measurement 3:

Subject	Right arm (kg)	Left arm (kg)
1	35.7	29.2
2	38.4	35.9
3	26.1	30
4	29	27.7
5	27.8	20.5
6	24.8	21.1
7	26.9	24.4
8	16.6	17.6
9	26.6	26.8
10	26.5	30.5
11	32	28.1

Strength measurement 4:

Subject	**Right arm (kg)**	**Left arm (kg)**
1	43.3	40.6
2	52.3	48.5
3	37	38.7
4	47	42
5	35.3	31.2
6	26.6	25.7
7	45.6	40.7
8	25.5	27.7
9	35.1	31.6
10	40.2	40.3
11	40.8	37.5

Hang times in pull-up bar:

Subject	**First set (s)**	**Second set (s)**
1	Not recorded	Not recorded
2	Not recorded	Not recorded
3	44	22
4	73	33
5	46	27
6	48	20
7	59	18
8	56	20
9	27	26
10	61	26
11	35	18