INCREASE AND REHABILITATION OF STRENGTH OF HAND AND FINGERS

Skuratovich Anatoli S.
The Belarus State University of Physical Culture, Minsk, Belarus. Department of Rehabilitation and Biomechanic.

Introduction

The hand and fingers are very important in life and sport activities. The purpose of this investigation was to devise effective means for rehabilitation of hand and fingers after injuries.

Methods

The device is intended for being applied to the muscles of fingers through mechanical oscillations (Figure 1). The period of study lasted three weeks: 9 training sessions, 4 minutes each. Biomechanical stimulation was applied to the group. Biomechanical stimulation is a kind of vibration massage method developed by us which is defined by the application of vibration along the fibers of active muscles [1]. While pressing the buttons with fingers vibration is transported to the muscles of hand and fingers. The frequency of contraction and extension of muscles is preset in limits of 15 – 30 Hz, and because the range of vibration is 2 – 4 mm, injury not possible.

Figure 1. -- Device for increase and rehabilitation of strength of hand and fingers

Results and Discussion

Fifteen students (basketball, tennis, volleyball players) took part in the experiment. Changes in the strength of fingers and hand were controlled by means of hand dynamometer (Table. 1)

	Dynamics of changes in right hand strength (kg)					*Dynamics of changes in left hand strength (kg)*				
Day	**1**	**3**	**5**	**7**	**9**	**1**	**3**	**5**	**7**	**9**
1	55	52	55	56	57	39	40	41	44	43
2	48	56	56	55	56	52	48	52	54	55
3	70	72	72	74	74	62	68	69	67	69
4	60	60	59	67	68	64	67	65	66	66
5	46	49	52	54	55	40	45	50	50	49
6	60	68	69	72	71	68	70	70	68	70
7	56	64	63	64	64	58	60	60	61	62
8	58	59	61	60	62	42	46	52	52	53
9	26	30	31	32	32	20	27	30	31	30
10	30	37	40	40	42	25	27	34	36	38
11	34	32	35	36	36	22	33	34	33	34
12	35	38	39	38	39	28	29	31	32	31
13	31	33	34	35	34	28	30	32	33	33
14	29	29	30	32	32	27	29	29	30	30
15	29	33	32	37	37	30	34	32	36	36

Table 1. -- Dynamics of changes in hand strength

and statistically analyzed with a validity index of 95%. The application of the devised methods led to an average delta gain of 6.13±0.84; 6.27±0.98 in the right and the left hand, respectively (t=6.37). Statistical analysis proved that the results were valid with a validity index of 95%.

The algorithms of statistical test of the difference average values of two dependent samples are the following.

First of all, we must find one difference matched sample, as result, we have one small sample.

At first we test normal distribution of sample according to Shapiro-Wilk's criterion (W>0,859 null hypothesis is accepted that the sample is normal with n=15 the degree of freedom with a 95% probability). If sample is normal, then according to Student's criterion (t-distribution) we check the significance of the statistical difference of average values $t=|X|*\sqrt{(n)}/\sqrt{(Dx)}$ (where X is the X sample average, Dx – X sample variance, n – the number of tested individuals).

If t>2,14 with n=14 degrees of freedom, significance level = 0,05, then we accept an alternative hypothesis, that sample average is different, with 95% probability (Table. 2, Fig 2).

Day	*Dynamics of changes in right hand strength average (kg)* 1-3	1-5	1-7	1-9	*Dynamics of changes in left hand strength average (kg)* 1-3	1-5	1-7	1-9
Average	3	4,07	5,67	6,13	3,71	4,79	6,02	6,37
Variance	3,57	3,35	3,24	3,25	3,34	4,1	3,78	3,81
Standard error mean	0,92	0,86	0,84	0,84	0,86	1,06	0,98	0,98
Shapiro-Wilk criterion.	0,936	0,96	0,948	0,915	0,922	0,85	0,889	0,891
Student's criterion	3,26	4,7	6,77	7,31	3,71	4,79	6,02	6,37

Table 2. -- Significance of statistic difference of average delta gain hand strength values with 95% probability

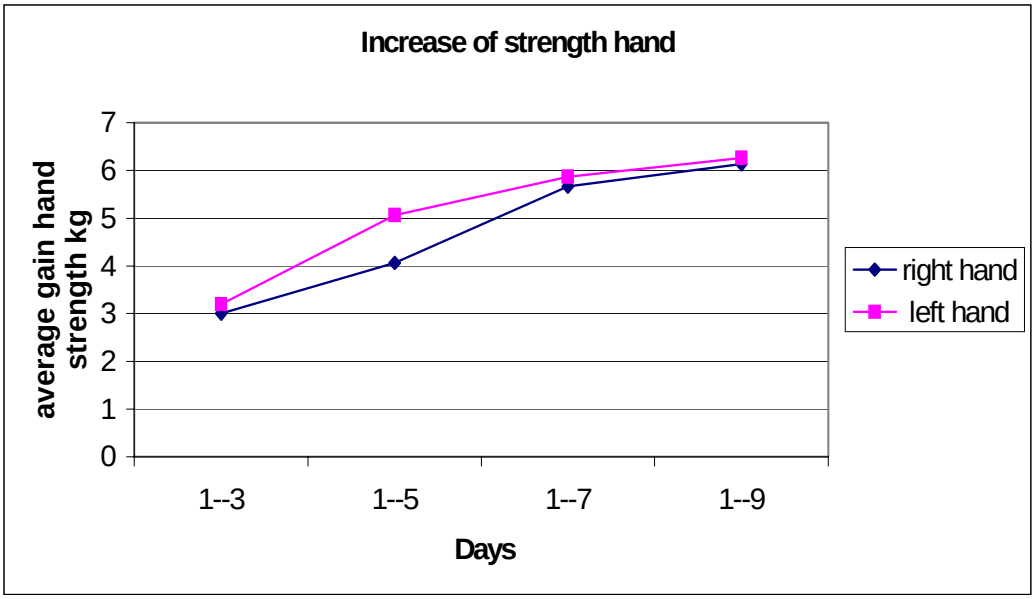

Figure 2. -- Dynamics of increase in hand strength average

If at least sample is not normal, we check the difference sample average values according to nonparametric rank test Wilkokson.

The effect of vibration is achieved as we believe due to a better blood circulation and a stronger influence on muscle mechanical receptors.

Conclusions

The device can be used by people of various trades, whose activities require a load applied to

hand and fingers, for example: typewriters, musicians, athletes: boxers, karatists, basketball players, tennis players volleyball players etc. The application of this devices and methods makes it possible to speed up the recovery after injuries by many times [2].

The application of the device contributes to the adjustment of the load on every finger separately, which the already known devices don't do. The device makes it possible to monitor the movements which are difficult to perform even for healthy individuals, the device makes the individuals do them. For example, try to raise up the forefinger and the ring- finger, and at a time to drop the middle and small fingers, and then to fulfill this movement in the reverse order. You won't manage it even if you do it slowly.

Application of such complex coordination movements is of a particular importance during post-injury rehabilitation; like apoplectic stroke and brain injuries [3].

Indication

1. Nervous system disorders:
   a) neuritis;
   b) plexits;
   c) neuromyosits;
2. Join diseases: non-specific and degenerative dystrophic ones;
3. Post-fracture, post injury and post-strain phenomena;
4. Rehabilitation of post insult mobility;
5. Rehabilitation and improvement peripheral blood circulation;
6. Rehabilitation mobility after vertebral column injuries;
7. Rehabilitation mobility after cerebral paralysis [4].
8. Preventive means for practically healthy men.

Contra Indication

1. Generally adopted for physiotherapeutic treatment;
2. Acute fevers;
3. Any local acute processes;
4. Acute stage of chronic diseases;
5. Susceptibility to blood-fluxes;
6. Varication;
7. Thrombophleitis;
8. Vessel aneurisms;
9. Lymphnoditis [4].

Acknowledgment.

The authors acknowledge technical supports of Mrs. Senko Sofia for the translation of the paper into English

References

1. A. Skouratovich. Device for rehabilitation of fingers mobility in musicians. World Congress on Arts an Medicine, New York, 1992
2. A. Skouratovich. Device for rehabilitation of finger mobility. XIII International Symposium on biomechanics in sports. Lakehead University, Thunder Bay, Ontario, Canada, 1995
3. T. Polyakova, A. Skouratovich, M. Pankova, D. Sagaidak, Ben Sharada Monder. Rehabilitation of hand and fingers mobility my means biomechanical stimulation, pp. 82-85, Minsk, Belarus, 2002
4. A. Sheidin. Apparatus massage, pp. 38-40, Minsk, Belarus, 1988