

7-1948

Heavy Resistance Exercises

Clarence W. Dail

College of Medical Evangelists

Evelyn Britt

College of Medical Evangelists

Isobel Hansen

College of Medical Evangelists

Follow this and additional works at: <http://scholarsrepository.llu.edu/medartssciences>



Part of the [Physical Therapy Commons](#)

Recommended Citation

Dail, Clarence W.; Britt, Evelyn; and Hansen, Isobel (1948) "Heavy Resistance Exercises," *Medical Arts and Sciences: A Scientific Journal of the College of Medical Evangelists*: Vol. 2: No. 3, Article 4.

Available at: <http://scholarsrepository.llu.edu/medartssciences/vol2/iss3/4>

This Comments is brought to you for free and open access by the Loma Linda University Publications at TheScholarsRepository@LLU: Digital Archive of Research, Scholarship & Creative Works. It has been accepted for inclusion in Medical Arts and Sciences: A Scientific Journal of the College of Medical Evangelists by an authorized administrator of TheScholarsRepository@LLU: Digital Archive of Research, Scholarship & Creative Works. For more information, please contact scholarsrepository@llu.edu.

CURRENT COMMENT

HEAVY RESISTANCE EXERCISES*

CLARENCE W. DAIL, M.D.

EVELYN BRITT, R.P.T.T.

ISOBEL HANSEN, R.P.T.T.

The past decade has witnessed great progress in the treatment of muscle weakness and atrophy, paresis, and paralysis. The therapy of poliomyelitis has been advanced by the contribution of Sister Kenny. Wehrmacher, Thomson, Hines, and Melville have demonstrated that electrical stimulation of denervated muscle under tension definitely retards atrophy and weight loss. Fries observed that a short period of systematized exercise daily would produce a demonstrable increase in strength in those muscle groups which were made to develop active tension during exertion.

Of great practical significance, however, is the recent work of DeLorme, with heavy resistance exercises for the building of muscle power. His program was developed during the war for the purpose of hastening the recovery of wounded soldiers. Its value in civilian practice, however, for the restoration of muscle power following industrial, traffic, and other injuries is immediately apparent.

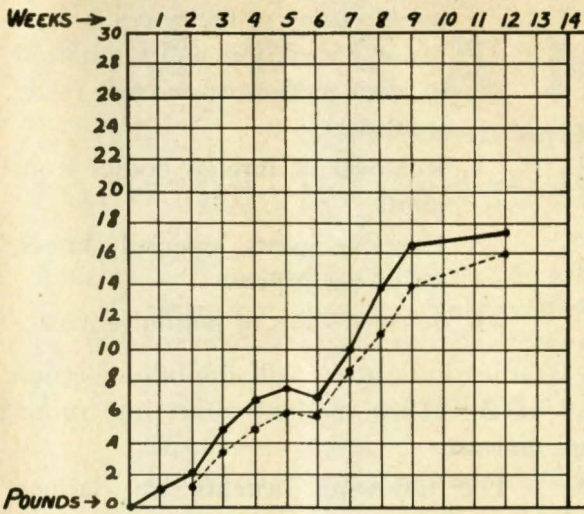
According to DeLorme, high-resistance exercises produce hypertrophy and increased muscle power in proportion to the resistance which the muscle must overcome. High-repetition, low-resistance exercises, on the other

hand, increase endurance but do not greatly enhance muscle power. It is important to develop power first, then to work for endurance. To produce maximal hypertrophy, the heaviest load should be imposed upon the muscle as it approaches complete contraction, and not when it is stretched. In the stretched state muscle has better mechanical advantage, and fewer fibers can overcome the given resistance than if the muscle were not in this condition. This is well illustrated by extension of the knee from the sitting position. With a weight attached to the foot, as in the DeLorme method, the maximum resistance occurs as the leg approaches the horizontal. Exercise for the knee flexors may be performed from the standing position, with a weight attached to the foot, or by means of a horizontal pull on a weight suspended over a pulley. The same principles are applied to other joints.

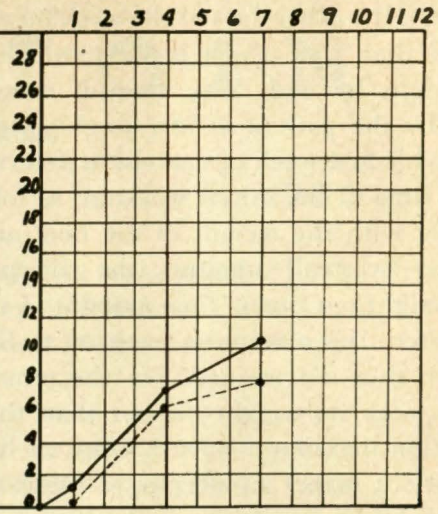
DeLorme's heavy resistance program provides a system of graduated exercise for the development of muscle power. The patient exerts his maximum power but once weekly. The maximum quadriceps power, for example, is taken to be the maximum weight in pounds which can be raised to the point of complete extension for one time. This maximum power, or as DeLorme calls it, the one repetition maximum, is determined once each

*From the Department of Physical Medicine, College of Medical Evangelists.

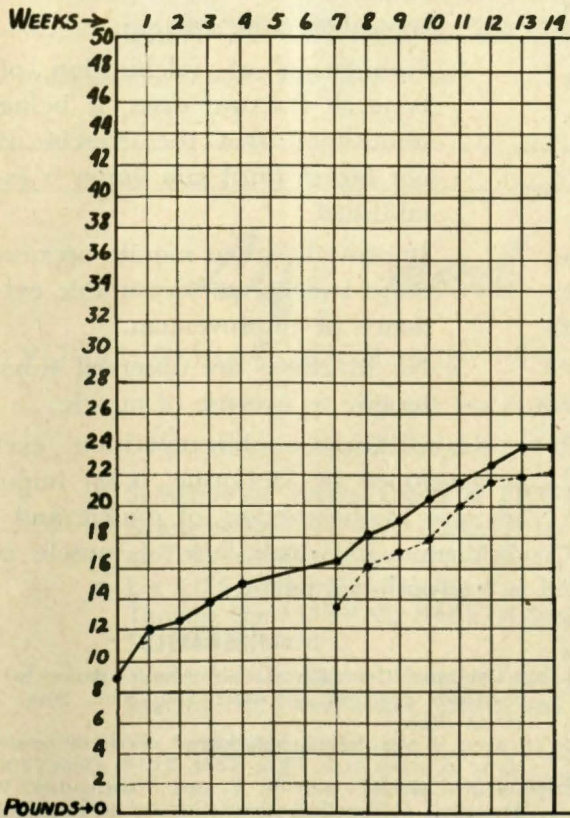
GRAPH 1.—The solid lines indicate one repetition maximum; the broken lines, ten repetition maximum weights. →



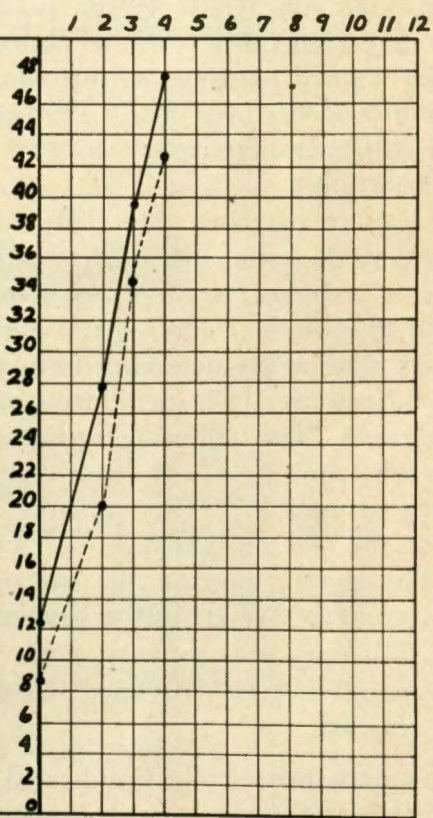
C.S.-O.P.D. 75582 -- RT. QUADRICEPS
FRACTURE of RIGHT PATELLA



E.G.-O.P.D. 191-822 --LT. QUADRICEPS
PATELLECTOMY -- POSTOPERATIVE



J.H. HOSPITAL NO. 128-407 -- RT. QUADRICEPS
POST POLIOMYELITIS



Q.C. O.P.D. 237-656 --LT. QUADRICEPS
QUAD. ATROPHY FOLLOWING INJURY

week. On the other days of the week no weight heavier than that which is maximum for ten repetitions is used. The amount of weight lifted by the patient at any single extension during his first week of exercise is determined at the time of his initial workout, as follows: Starting with the weight of the boot and increasing by small amounts, the patient lifts each weight ten times. That amount of weight which requires maximum exertion to lift ten times is thus determined. For the remainder of the week no weight heavier than this ten repetition maximum is used. Once each week the patient makes an attempt to increase this ten repetition maximum, and when this new load has been determined, no heavier weight is employed during the ensuing week. Since 70 to 100 repetitions must be performed in each workout, the ten repetition maximum weight is divided up into smaller units, each of which is lifted ten times so that when the maximum load has been lifted ten times the patient will have performed a total of 70 to 100 contractions.

The patient exercises once daily for five days each week. Following the determination of the one and ten repetition maxima on the fifth day of exercise, there is a rest period of two days. The newly determined ten repetition maximum weight is used during the succeeding week. The following measurements are recorded once weekly in quadriceps cases: 1. Range of motion; 2. circumference of the thigh; 3. the one and ten repetition of maxima. The graph showing the increase in muscle power in several types of cases as indicated, illustrates the rapidity with which muscle power can be developed by the DeLorme method.

Heavy resistance exercise is indicated in the following conditions:

1. Fractures.
2. Synovectomy, meniscectomy, or

- patellectomy of the knees.
3. Muscle weakness and limitation of joint motion due to soft tissue wounds.
4. Removal of foreign bodies from joints.
5. Unstable joints, especially knees, following injury.
6. Selected cases of poliomyelitis.

Other indications will doubtless become apparent as the method comes into more general use.

The following benefits are claimed for heavy resistance exercises:

1. Increased muscle strength through hypertrophy of muscle fibers.
2. Increased range of joint motion.
3. Stimulation of calcification of bone in fracture cases, it being understood that the exercise is not begun until safe union is established.
4. Improved patient morale because there is concrete measurable evidence of improvement.
5. No ill effects are observed from fatigue or overuse of muscle.

Heavy-resistance, low-repetition exercise, as developed by DeLorme, is an important advance in the therapy of muscle and joint conditions in which lack of muscle power is a prominent factor.

BIBLIOGRAPHY

- DeLorme, T. L.: Restoration of muscle power by heavy-resistance exercises, *J. Bone and Joint Surg.* 27:645 (Oct.) 1945.
- Fries, E. C.: Some physiological effects of passive and active exercise, *Arch. Phys. Ther.* 25:546 (Sept.) 1944.
- Hines, H. M.; Melville, E.; and Wehrmacher, W. H.: The effect of electrical stimulation on neuromuscular regeneration, *Am. J. Physiol.* 144:278 (July) 1945.
- Wehrmacher, W. H.; Thomson, J. D.; and Hines, H. M.: Effects of electrical stimulation on denervated skeletal muscle, *Arch. Phys. Med.* 26:261 (May) 1945.