

Series II. Massage.

Massage has the capacity to modify the condition of the muscle tissue without the intervention of the will of the patient, and pressure and manipulation may lead to circulatory changes which cause a more rapid removal of the acid fatigue elements.²⁷

Pemberton, Cajori, and Crouter²⁸ state: "It seems fair to deduce, therefore, that the production of lactic acid by muscle, as revealed in the circulating blood, depends chiefly or entirely on active contraction of the muscle, *per se*, as induced by the usual nerve stimulus, and cannot be brought about by extraneous mechanical stimuli of therapeutic degree. This is noteworthy, and probably explains the applicability of massage and rubbing to exercised, fatigued, and even injured muscles. If massage produced additional amounts of lactic acid the benefits to overexercised muscles would be difficult of explanation. Experience, however, has shown that massage, in the form of a vigorous rub-down, has a definite value to both human beings and horses after exercise. Lacking any further addition of the lactic acid, the changes thus induced in the local blood supply permit, presumably, a more rapid removal of that already present." Kovacs²⁴ claims for massage an improved circulation, a hastened absorption and a relief of stiffness and pain.

The work of Mosso and Maggiora¹¹ compared the effect of massage on the flexors of the fingers, and found that after massage the muscles were capable of doing twice as much work as they could do under ordinary conditions, and Maggiora also demonstrated the increased ability of the muscles by massage after prolonged intellectual work on general bodily fatigue brought about by a wakeful night. His finding that a period of five minutes massage obtained the maximum results was not confirmed in the tests which were conducted, although it should be borne in mind that the conditions in each case are not exactly parallel.

Zabludowski²⁹ was perhaps the first to investigate the influence of massage on directly fatigued human muscle. He found that after severe exercise "a rest of fifteen minutes brought no essential

recovery, whilst after massage for the same period the exercise was more than doubled." Other experiments were conducted with somewhat similar results by Brandis, Ruge, and Rosenthal.³⁰

The form of massage used in these experiments consisted of effleurage, friction, and petrissage, it being recognized that deep manipulation was necessary in order to effect any change in the deep seated tissues. Graham²⁹ says: "I have always maintained that manipulation, kneading, or petrissage is of more value than all the other procedures of massage put together." The effect of the application of massage was most noticeable in the change of texture, the forearm losing to a large extent its knotted, hard, tense, resisting nature, and a greater degree of pliability, softness, and comfort was the result.

The average recovery percentage for all thirty tests was 108%, or 25.8% more than the recovery under rest alone.

Special Series:

- (a) Two minutes' rest.
- (b) Two minutes' massage.
- (c) Five minutes' rest.
- (d) Five minutes' massage.

Fifty-seven individuals were tested in two hundred and thirty-two experiments with a specially constructed ergograph. In these experiments the flexors of the elbow joint were fatigued by isotonic contractions in raising a weight of 6.5 kilos. The methods used were similar to the ten minute series, except that the periods of rest and massage were confined to two minutes for one group and five minutes for the other, and the contractions and relaxations each occupied one second instead of one-half second. The following figures indicate the results secured:

Series (a):

Contraction to absolute.	} 50.5% recovery.
Two minutes' rest.	
Contraction to absolute.	

Series (b):

Contraction to absolute.	} 51.5% recovery.
Two minutes' massage.	
Contraction to absolute.	

Series (c):

Contraction to absolute.	} 62.5% recovery.
Five minutes' rest.	
Contraction to absolute.	