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Effects of Oxford and De-Lorme exercises on quadriceps muscle

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Objective The purpose of this study was to determine the hypertrophy occurring in quadriceps muscle after Oxford and De-Lorme exercises in healthy subjects by computed tomographic area measurement, and compare with the controls.

Methods 30 healthy untrained volunteers were randomly selected. All subjects were male and mean age was 19.8±1.54. Subjects were assigned into three groups of 10 people and were exercised for four weeks. The first group took part in Oxford exercise group, the second De-Lorme group and the third group did not do any exercise. The computed tomographic sections were taken from the thigh. The CT scan of the thighs were made halfway between the pubic symphisis and the mid-point of patella to calculate total thigh area. Thigh girths at the level of midthigh had been measured up to 20 cm from mid-patella. The evaluations were made before starting exercise and after four-week exercise program.

Results In Oxford and De-Lorme groups midthigh composition from computerized tomographic scans showed an increase in total quadriceps area. Increase in quadriceps muscle area was associated with thigh girths .

Conclusion We concluded that both Oxford and De-Lorme exercises produced significant muscle hypertrophy.

Key words Oxford, De-Lorme exercise, quadriceps muscle, computed tomography.

Introduction

The chief characteristic of muscle hypertrophy program is that all weight lifting exercises are done in sets of lifts and repetitions; the weight is not released until the completion of certain number of repetitions or sets(1). Dynamic exercise is the most frequently used form of exercise when strength and hypertrophy are desired(2). Weight lifters reject isometric exercise because they do not increase bulk, or endurance, because a plateau of strength improvement is reached fairly soon(1). According to Moritani (3) a muscle does not grow larger or stronger unless it is overloaded and isometric resistance exercise is the most rapid method of increasing muscle strength. Another advantage of the isometric resistance exercise of quadriceps is to produce minimal transarticular force during training. Fisher et al. reported that both isometric progressive resistance and progressive resistance (De-Lorme) exercise produced significantly more hypertrophy in vasti muscles than isometric exercise and control group(4).

The purpose of this study was to quantify hypertrophy that exercises produced in quadriceps muscle by computed tomographic measurement and to determine the hypertrophic effect of Oxford and De-Lorme on quadriceps muscle.

Material and Method

Patients

Thirty young high school physical education students were assigned in three groups. All subjects were male and ages ranging from 18 to 21 years (average age 19.8±1.54). Ten subjects in each group were exercised for four weeks. The other basic values of groups are seen in Table 1. The first group performed Oxford exercises, the second group De-Lorme exercises and the third group, controls, did not do any exercise.

Exercise program

Oxford exercises: Ten repetitive maximum (10 RM) was determined weekly. According to method of Oxford patients performed three sets of 10 repetitions for the extensors of the knee five times a week: 10 with full 10 RM, 10 with three thirds of 10 RM, and 10 with half of 10 RM (5).

De-Lorme exercises: Ten repetitive maximum (10 RM) was determined weekly. According to De-Lorme, patients performed three sets of 10 repetitions for the extensors of the knee five times a week: 10 with half of 10 RM, 10 with threefourths of 10 RM, and with full 10 RM (1).

Radiographic assessment

Computed tomography: At the beginning and at the end the of exercise program computed tomographic scanning was made on both thighs including the skin. The patients were examined in supine position with thigh relaxed. The muscle cross-sectional area of both legs were measured simultaneously with Hitachi TC 450. Five mm wide scans were taken at marked levels. The measurements were made just from the mid-point of femur bilateral. The mid-point was calculated as the point between the symphisis pubis and the mid-point of patella. The

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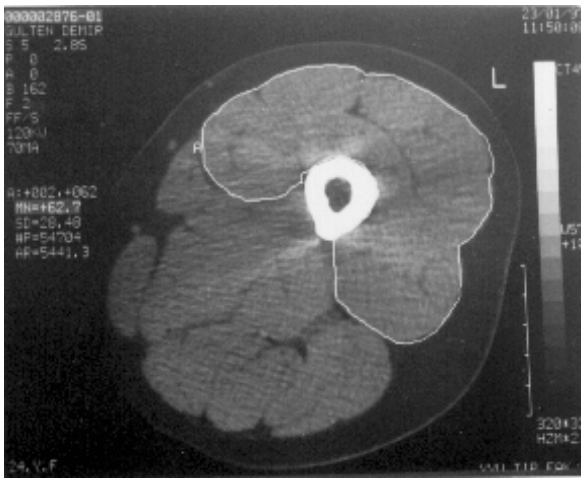
cross-section areas were measured with the millimetric paper on hard copies from CT. The device was assigned threshold values for fat, bone and muscle area by correcting for intramuscular fat. The area of the quadriceps was identified and measured by manual planimetry. Non-quadriceps area was obtained by substracting the planimetrically measured quadriceps area from total muscle area, as shown in the figure.

Figure 1. Cross section of quadriceps muscle



Data Analysis

Minitab for Windows 9.2 program was used for statistical analysis. Means and standard deviations for the measured parameters were determined. Determination of difference between pre and post exercise cross-sectional area and thigh circumferences for each group were calculated using Wilcoxon matched pairs signed-ranks test.

Results

All subjects, starting the exercise program, finished the entire protocol. The two exercise and control groups were comparable with respect to gender, mean age, height and weight (Table I).

The increase in the thigh muscle cross-sectional area over the four-week period is shown in table 2. Oxford exercise produced statistically significant hypertrophy in the quadriceps area. De-Lorme exercises also produced significant hypertrophy in the quadriceps muscle area. Increases in the control group were small and not significant.

Table I. Demographic data

Variables	Groups Oxford (n=10)	De-Lorme (n=10)	Control (n=10)
Age(years)	19.9±1.85	19.7±1.34	19.7±1.68
Height(cm)	172.8±3.85	174.7±5.29	175.6±4.82
Weight(kg)	67.5±8.34	67.3±3.97	66.4±4.72
BMI	22.6±2.61	22.1±1.27	21.5±1.34
Smokers	5	5	5

Antropometric measurements

Bilateral changes in thigh circumferences at the level of 20 cm above the mid-point of patella were statistically significant ($p<0.05$) in both groups.

Discussion

It has been recognized that certain types of exercise, after a while, increases muscular size, usually associated with increases in muscular strength (5). The present results confirmed that both resistance exercises (Oxford and De-Lorme) increased quadriceps area. And increase of girdle occurred in exercised groups but not in controls. Dynamic exercise is the most frequently used form of exercise when strength and hypertrophy are desired (2).

Table II. Antropometric changes and changes of cross-sectional area of the quadriceps.

		Oxford PRE Mean ± SD	De-Lorme PRE Mean ± SD	Control Mean ± SD
Body weight	Pre	67.5±8.34	67.3±3.97	66.4±4.72
	Post	67.3±7.26*	67.4±5.62*	66.5±5.44
Quadriceps area	Pre	7376±973	6915±480	7124±666
(right)	Post	8101±1003**	7461±475**	7162±724
	8.59%	9.94%	7.95%	
Quadriceps area	Pre	7231±986	6891±514	7084±608
(left)	Post	7758±1051**	7315±540**	7066±605
	6.74%	7.31%	6.17%	
Girth	Pre	44.3±3.33	44.0±2.75	44.2±2.64
(right)	Post	47.6±3.53**	46.7±2.58**	44.3±2.32
	6.83%	7.46%	6.19%	
Girth	Pre	43.8±4.13	44.1±2.81	43.5±3.14
(left)	Post	47.0±4.47**	46.8±2.70**	43.5±3.26
	6.74%	7.30%	6.18%	

*: $p<0.05$, **: $p<0.01$

Fisher et al (4) reported both progressive resistance and isometric progressive resistance exercises produced hypertrophy in the quadriceps muscle in osteoarthritic patients, but they recommended isometric progressive resistance exercise for knee arthritic patients because of its minimal transarticular forces. Cureton et al (6) suggested that CT investigations were more useful than manual measurements of the circumference of the extremity and the muscle biopsies. Dons et al (8) tested the increase in gross muscle section in eighteen young males after performing weight lifting exercise. The increases were 11,17, and 10% in controls, 50% and 80% groups,respectively.If all three groups were treated as one, the increase was 13% ($p<0.01$).

The application of exercises has been shown to increase strength with subsequent muscle hypertrophy. Young subjects showed strength gains due to neural factors only at the initial stage, with hypertrophy becoming the dominant factor after the first 3 to 5 weeks of training (3,8)

In conclusion we found that regular progressive resistive exercise such as Oxford and De-Lorme were producing hypertrophy in healthy young subjects while untrained non-exercise group did not show any significant change in the quadriceps area.

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