A study to compare the Delorme and DAPRE strength training regimens

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Abstract:

The strength training is an essential tool for rehabilitation of patients and also as component of fitness . hence it becomes important for a therapist to understand the strength development potential of various regimes available . This study is performed as a Pretest-posttest experimental research design. 50 subjects were included and were randomly assigned to one of the treatment group: Delorme group and Dapre group. Strengthening Regimen was conducted for a period of 6 weeks in both the groups. One repetition maximum was the outcome measure . this was assessed at baseline reassessed at the end of 6 weeks. A paired t-test was used to evaluate results within the group. Students's t test was used for between the group analysis. the results of the study shows significant improvement in one repetition maximum with Delorme as well as the DAPRE group. DAPRE group shows statistically significant effects on strength gains on between group analysis (t = p_<0.01). Within the group both the groups were significantly effective in one repetition maximum after the intervention (p_<0.01).

The study concluded that Daily Adjustable Progressive Resistive Exercise (DAPRE) is recommended as it is having sustained effects at follow up.

Key words: One repetition maximum, Delorme regimen, DAPRE regimen

Introduction

Resistance training is a vital tool in rehabilitation and fitness and its growth has been exponential, as it is helpful in improving muscular strength, power, endurance and motor execution.1.

Progressive resistance training regimes are able to produce adaptations as per need analysis which is predetermined by assessment. The paramount conditioning principle of resistence training is overload, specificity and variations2. Graded escalation in demand placed on body is required and can be gained by manipulating one of the below mentioned variables3. 1)Exercise intensity (load for a given exercise/movement) may be increased; 2) Total repetitions performed at the current intensity may be increased;3) Repetition speed/tempo with submaximal loads may be altered according to goals;4) Rest periods may be shortened for endurance improvements or lengthened for strength and power training; and 5) Training volume (total work represented as the product of the total number of repetitions performed and the resistance) may be gradually increased (e.g., 2.5-5%).

The magnitude of improvement depends upon the individual's training status and genetic predisposition4. Traditionally, the 1-repetition maximum (1-RM), is the maximum load that can be moved through the full arc of motion in a proper and controlled manner with good posture. This has been the standard for dynamic strength assessment5.Reserchers suggests that novice lifters should not be permitted to undergo 1 RM testing to prevent muscular injury 6. The solution for novice lifters lies in prediction equation which help in estimating weight for larger muscle mass exercises for male subjects 7 . the injury chances associated with novice lifter testing for 1RM are eliminated by using the prediction equations . As per Delorme strength training exhibits swifter results in atrophied muscles if high load and less repetition are used. The authors concluded that magnitude of resistance is directly linked to muscular hypertrophy8.The above mentioned authors recommended upper limit of repetition as 20-30 as greater than this would lead

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to development of endurance8.interfering factors for strength evaluation include learning aspect , inability to generate maximal force, and fear of discomfort9. Due to this, DeLorme was of the opinion that the initial 10RM was mostly wrong estimation of a subject's strength. Initial brief surge in strength occurred followed by lesser gains in strength 8. Warm up lifts were conducted with lesser weights and lesser repetition in order to avoid fatigue.8. These initial lifts served as learning tool , warm up measure, so that maximum exertion is performed..In performing the DeLorme technique, Zinovieff faced persistent trouble due to exhaustion of the quadriceps muscle during the last phase of the exercise regimen 9 .10 RM was not completed due to temporary failure of muscle 10. As the fatigue set in full ROM was not available and only the few trained could execute it. Many authors have suggested that the 10RM should not be the apex target in strength training.12,13. Instead, the target should be to generate muscle exhaustion 14..Linnamo et al. looked at fatigue and recovery of a muscle with explosive loading 15. Chilibeck et al. did research on women strength training and concluded that magnitude of hypertrophy was lesser than in males 16. Charette et al. found that age is not a interfering factor to develop strength and hypertrophy in elderly females.17.

Till the advent of the Daily Adjustable Resistive Exercise technique (DAPRE), there was no means to determine either the optimal time to increase resistance or the optimal amount of weight to increase the resistance22 .The DAPRE technique is considered to overcome these pitfalls. The efficacy of strength training is proven but there are conflicting results for the most efficacious way to train. The aim of this study was to evaluate the efficacy of the two PRE regimes.

Methods

This study has a Pretest- posttest experimental design . Subjects were included as per following inclusion criteria: 18 to 26 years of age of either genders , within normal BMI (21-23), who had right-handed dominance, and who were willing to participate and abide by the instructions given for the purpose of the study. Exclusion criteria involved having any neuromuscular deficits,cognitive deficit,sensory dysfunction in the tested limb, soft tissue injury or skin laceration in arm and forearm region, any surgery in the tested side , had fracture in the test-side upper limb ,any cardiovascular and respiratory problems,any history in involvement in any kind of resistive training in the past 6 months.

Procedure

Sixty subjects were screened with the help of history taking for exclusion. The fifty four subjects met the inclusion criteria. A detailed explanation about the procedure was given. And subjects were then asked to read and sign the informed consent. Fifty subjects were recruited and participated in the study. The subjects were then divided into two groups by simple randomization. Demographic data and dependent variables were recorded. After randomization pre-intervention measures of 1 RM (Repetition Maximum) was taken. 1RM is the commonly used procedure to assess muscle strength. It is a reliable and valid method(r =0.79-0.99) 18. The subject was asked to on a chair (without arm rest) in high sitting position, elbow extended (right side) to facilitate the testing of biceps brachii muscle. Range of motion for testing was from 0 degrees (full elbow extension) of elbow flexion to 120 degrees. To prevent elbow abduction with training and testing , a Velcro strap was used to stabilize the elbow. Prior to the repetitions-to –fatigue attempt, the subjects performed 6 to 10 warm-up repetitions with 50 % of the estimated workload. The subjects were told to try to perform the most of repetitions until the offered resistance was impossible to be sustained. The athlete is asked to develop synchrony between beep sound and movement . the beep timing is adjusted such that the subject can do the training with comfort without compromising exercise form. A metronome will time the performance of the movement so that the accuracy is further maintained .From the equations available in the literature,the mathematical model proposed by Bryzcki was chosen to estimate one repetition maximum from n-repetition maximum 19:

1 RM = weight lifted during n RM / (1.0278 - .0278(n))

The subjects were familiarized before start of the study so that chances of reproducibility are higher. Each group respectively underwent an intervention for six weeks depending upon their designated group. Subjects in Delorme group ,on the days of exercise training (Monday, Wednesday, and Friday), performed some light stretching and warm-up exercises such as mild walk for 10-15 minutes 10. The 10 RM was determined by using the prediction equation: 10 RM is 75% of 1 RM 19. The group began their first set of ten repetitions at 50% of 10 RM ,the second set of ten at 75% of 10 RM , and the third

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set of ten at 10 RM(with a slow to moderate speed that is 2:2). Each lift was controlled in both concentric flexion and eccentric extension of the elbow corresponding to the "flex" and "extend" of the metronome 10. Inter set rest time was fixed at 1-minute. During each repetition the joint flexed and extended as fully as possible with a brief (one-third of a second) pause at the two extremes of the motion. At the beginning of the next week of training , a new 10 RM was established and based upon the established 10 RM the protocol was followed.

Subjects in the Daily Adjustable Resistive Exercise group (daily except on Sundays) performed four sets of exercises was 6RM was determined from the prediction equation of 1RM .6 RM is 86% of 1 RM 20. The first two sets consisted of ten and then six repetitions, performed against one-half and three-fourths of the previously established working weight. These repetitions were performed deliberately (although not too slowly with a slow to moderate speed that is 2:2) During each repetition the subject had to move the joint through full range with a brief (one-third of a second) pause at the two extremes of the motion 21. These sets act both to warm-up and to educate the muscles and neuro-muscular structures involved 21.The full working weight was used on the third set, and the subject performed as many repetitions as possible. The number of full repetitions performed on the third set was used to determine the adjusted working weight for the fourth set. Maximal repetitions were performed on the fourth set, and the number performed was used to determine the working weight for the next day 21. Subjects were instructed to refrain from a sudden jerk or explosive contraction at the beginning of extremes of flexion and

extension, and to control the weight during the eccentric phase of the repetition 10. Each lift was controlled in both concentric flexion and eccentric extension of the elbow corresponding to the "flex" and "extend" of the metronome with the normal breathing pattern (exhale while lifting the weight and inhale while coming back to the starting position)10. 1-minute rest is provided between each set. The outcome variable (1 RM) was measured after 6 weeks of intervention.

Statistical analysis

Data analysis was done using SPSS software (version 10.5). Students's t test was used for in between analysis and paired t test was used for within group analysis for both the groups.

Results

subjects in the two groups were homogenous with the mean age 22.12yrs.,weight 61.46kg,height 1.67 m, and BMI 21.91.The results of the study shows significant improvement in strength (1-RM) with Delorme as well as Dapre groups in within group analysis.Dapre group shows more significant effects on strength gains(1-RM) which was analyzed with t-test as compared with Delorme group as showm in table and fig. . The level of significance was decided at p<0.01.

The table 1 shows, that the two groups Delorme and DAPRE are homogenous regarding demographic details as age, height, weight and BMI.

Percentage increase in the value of strength gains -

Group 1(Delorme)

Table 1 : Comparison of Age, Weight, Height, BMI between two groups (Group 1=Delorme, Group 2=DAPRE)

	Grp.1(N=25)		Grp.2(N=25)		t-value
	Mean	SD	Mean	SD	
Age	22.12	1.53	21.72	1.69	.87
Wt.	61.46	7.79	62.83	8.03	.61
Ht.	1.67	.057	1.69	.076	1.30
BMI	21.91	2.16	21.73	1.77	.32

NS Non significant at p<=0.05

Post RM – Pre RM *100

    Pre RM

  5.68 - 4.82 *100 =17.84%

    4.82

Group 2 (DAPRE)

  Post RM – Pre RM *100

    Pre RM

  6.08 - 4.18   *100 = 45.4%

    4.18

Discussion

The backing of scientific evidence behind resistance training has popularised this means very much. It helps in improving neuromuscular functions well as maintaining or improving fitness.

Strength gain is the aim of many resistance training regimes. Poor muscular fitness increases the chances of neuromusculoskeletal injuries and pathologies and impairments. Therefore experimenting to find   the better regime for improving strength seems to be realistic for individuals of all ages and health levels 10.Thus, the present study emphasized on the determination of the optimal method of developing muscle strength 10. One group was administered Delorme while the other group performed the Daily Adjustable Resistive Exercise (DAPRE) regime. The effects of the interventions on Repetition Maximum was evaluated post-intervention.When analyzed within the groups ,both the groups showed statistically significant improvement in Repetition Maximum(table 2,table3)

Table 2 : Within group comparison of Pre and Post of 1RM in group 1 Delorme, paired t-test.(N=25)

**:significant at .05 level.

Table 3 : Within group comparison of Pre and Post of 1RM of group 2 DAPRE, paired t-test.(N=25)			
1 RM	Mean	SD	t-value
Pre	4.18	.802	26.87**
Post	6.08	.799	

** :Significant at .05 level

The subjects in the Daily Adjustable Resistive Exercise(DAPRE) regime showed statistically significant improvement in strength gains in terms of 1 Repetition Maximum, post-intervention (table 3,Fig 2). The Daily adjustable progressive resistive exercise technique utilizes the basic principal of progressive resistive exercise to a greater degree than do older programs.

The Daily adjustable resistive exercise technique allows for the individual differences in the rate at which a person regains strength in the muscle and provides an objective method for increasing resistance in accordance with strength increases. Thus this technique ensures that the subject works near his maximal capacity 21.

On within group analysis the subjects in the Delorme group also showed significant improvements in muscle strength in terms of 1Repetition Maximum(table 2,Fig. 1) . In 1945,Delorme introduced the concept of progressive resistive exercise to post surgical rehabilitation 10. One of Delorme's hypotheses is that the muscle should be warmed up by the time 10 RM is reached 10. The principle upon which it works is overload principle. 10.

On between the group analysis both the Delorme and Daily Adjustable Progressive Resistive Exercise (DAPRE) protocol group's subjects improved muscle strength as demonstrated by the difference in the repetition maximum measurement(pre and post- test)