The effect of foam roller exercise and Nanoparticle in speeding of healing of sport injuries

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Abstract: Strenuous physical exercise commonly results in muscle injury , especially when that exercise is intense, prolonged .Most common sports injuries are long muscle groups laceration such as hamstrings muscle. The aim of this study is to reveal the role of foam roller exercise program and drug Omega 3, 6, 9, vitaminE on Growth Hormone, stem cells CD34+% and speed of healing for fourth year in physical education with hamstrings muscle injury. 14 students (3 experimental groups) with injury were recruited for this study and 3 healthy students (control group) aged (20-22 yrs). Exercise program for 3 weeks (4 days / week) were used foam roller exercise, (Omega 3-6-9 vitamin E) 2 capsules in a day per 3 weeks .They were estimated using Immunophenotyping stem cells CD34+% , Growth Hormone and flexibility tests. Results: revealed a significant increases of GH and flexibility tests, a significant decreases of CD34+ % in (Second and Third) experimental groups. It is concluded that foam roller exercise and use of nanoparticle (Omega 3, 6, 9, vitamin E) affect all parameters positively.
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Key words: Foam roller exercise, Growth Hormone, stem cells CD34+% , Flexibility tests, Nanoparticle, healing of sport injury.

1. Introduction:

Skeletal muscles can be injured by external factors such as contusion, laceration, or crush(Huard et al.,2002), from road trauma, workplace accidents, or collisions on the sports field, or by internal factors such as strains, e.g. a hamstrings muscle tear when running or kicking (Brockett et al, 2004), or during surgery involving muscle laceration or during reconstructive or transplantation surgery, when muscles are excised by surgeons and transferred from one part of the body to another to provide supporting structures and help restore some level of function (Chan et al, 2005).

Strenuous physical exercise commonly results in muscle injury, especially when that exercise is intense, prolonged and includes an important eccentric component (Macintyre et al , 1995). Individuals may subjectively perceive the muscle damage approximately 24 h after exercise (Apple et al, 1985, Abalnave and Thompson, 1993).The initiating event may be related to high specific tensions produced by the muscle, which results in shearing of the myofibrils and disturbances in the metabolic milieu such as reduction in PH or increased temperature (Carova et al, 2006). The rapid breakdown of damaged muscle fibres and connective tissue is accompanied by the diffusion of intracellular components into the interstitium and plasma such as prostaglandins, heat shock proteins chemokines and free radicals and induce oedema (Armstrong, 1990). Objective indices of muscular damage include decreased force generation capacity (Clarkson et al, 1992) and disruption of Z- disks and cell menbrane damage visible by electron microscopy (Friden and Lieber, 1992).

Polyunsaturated fatty acid and (w-3,6) , Omega a-3 eicosapentaenoic acid and Docosahexaenoic acid , play an important role in the treatment and prevention of certain inflammatory diseases , they occur in higher concentration in lipids associated with structural elements of tissues. They tends to lower serum cholesterol, they posses an anti-atherogenic , anti-inflammatory and anti-mitogenic actions (Chatterjea and Rana Shinde, 2005).They are vital to the proper functioning of various tissues such as blood vessels, heart, eyes and nerves.

They also facilitate normal growth, development and function of some tissues (Das, 2000).Growth hormone and growth factors are small peptides which bind to membrane receptors to influence the various steps of the growth and development of cells through several signaling pathways (Chambers and Dermott, 1996).It has already been shown that they are capable of stimulating the growth and protein secretion of many musculoskeletal cells (Trippel et al, 1996).

During muscle regeneration, it is presumed that trophic substances released by the injured muscle activate the satellite cells (Alameddine et al, 1989). It is now realized that satellite cells in skeletal muscle provide the extra nuclei for post-natal growth (Schultz, 1996) and that they are also involved in

repair and regeneration following local injury of muscle fibres (Grounda,1998).

There is growing body of data that the cells defined as endothelial progenitor cells (EPCs) play a significant role in the reendothelialization and neovascularization of injured endothelium (Urbich and Dimmeler,2004). Asahara et al, 1999) provided the first evidence that the peripheral blood is a reservoir of bone marrow derived EPCs circulating in the blood vessel system and exhibiting reparative properties .

The number of EPCs as well as their proliferative potential may change under pathological conditions (Herbring et al, 2006).Estrogens and physical exercise were also able to increase EPC number in human and animal models (Adams et al, 2004, Imanishi et al, 2005, Strehlow et al, 2003). Ewa Miller and Pawet,(2007) indicated that EPC count and functionality may be affected by pathological physiological conditions and are associated with changes in the production and action of various factors, including hormones and growth factors and numerous drugs, they are able to regulate the functions of EPCs. Foam rolling is quickly becoming a staple in training programs worldwide. From elite athletes to weekend warriors, you can walk into many training facilities and see people using a foam roller as part of their regimen. Foam rolling can also provide an invigorating deep tissue massage. It relaxes the muscles after training or workout (Mike Robertson 2008). Foam rolling is a form of Self-Myofascial Release Therapy (SMRT). Foam rolling exercises can effortlessly target every part of the body that needs stretching. These muscles include the calves, hamstrings, gluteal muscles and the quadriceps. They help in the body's rehabilitation especially after an injury. The many benefits of foam rolling exercises are improve core strength, increase flexibility, release tension, pain relief , rehabilitate injuries, injury prevention.

The Aim of this study:

The use of foam roller exercise and nanoparticle in sport injuries therapy to reveal:

1. The role of foam roller exercise with nanoparticle (Omega3, 6, 9, vitaminE) on growth hormone, stem cell percent and speed of healing.
2. The role of foam roller exercise on growth hormone, stem cell percent and speed of healing.
3. The role of nanoparticle (Omega3, 6, 9, vitamin E) on growth hormone, stem cell percent and speed of healing.
4- Inhibition of pain for the three experimental groups.

Research hypothesis:

1. There are statistically significant differences for use of foam roller exercise with nanoparticle (Omega3, 6, 9, vitamin E) on growth hormone, CD34+ % and speed of healing
2. There are statistically significant differences for use of foam roller exercise alone on growth hormone, CD34+ % and speed of healing.
3. There are statistically significant differences for use of nanoparticle (Omega3, 6, 9, vitamin E) alone on growth hormone, CD34+ % and speed of healing.
4. Inhibition of pain for three experimental group and especially the group that used foam roller exercise with nanoparticle (Omega 3 ,6,9, vitamin E).

2. Materials and Methods

Participants:

14 students with hamstrings muscle injury (3 experimental groups) were recruited for this study and 3 healthy students (control group) aged (20-22 yrs). Experimental group takes (Omega 3, 6, 9, vitamin E) 2 capsules in a day per 3 weeks, exercise program for 3 weeks (4 days / week).They were estimated using Immunophenotyping stem cells CD34+ %, Growth Hormone GH and flexibility tests.

All participants were nonsmokers, non-diabetic and free of cardiovascular, lung, and liver disease. Participants did not take any medications that could affect EPCs number or function. These included statins, angiotensin II receptor antagonists, ACE inhibitors; peroxisome proliferators activated receptor (PPARα) agonist and EPO.

Written informed consent was obtained for all participants. All participants refrained from caffeine, and any medications 48 hours prior to test, which include blood withdrawal before and after exercise program.

Samples were classified into 4 groups (3 experimental and 1 control)by following:-

First experimental group (3 students take (Omega 3, 6, 9, vitamin E) alone.
Second experimental group (5 students use foam roller exercise alone).
Third experimental group (6 students use foam roller exercise with (Omega 3, 6, 9, vitamin E).
Fourth control group (3 students).

Note:

Researchers used control group for growth hormone and stem cell normal standard in healthy students to know the effect of injury on these variables.

Table (1) Mean ±, Sd., Range and Skew for Age, Length, Weight Variables (n=17)

S	Variables	Mean	SD. deviation	Range		SK
				Mini	Max	
1	Age	20.88	0.781	20	22	0.219
2	Length	165.24	4.323	159	173	0.092
3	Weight	71.94	9.370	54	80	-1.248

Skew Factor of all parameters were between (+, - 3)

Table (2) Mean ±, Sd., Range and Skew for (GH) and $CD34^+$ Variables (control group) (n=3)

S	Variables	Mean	SD. deviation	Range		SK
				Mini	Max	
1	Stem cell (CD 34+%)	.16	.02	.14	.18	.000
2	Growth Hormone (n/g)	.30	.02	.29	.33	.000

Skew Factor of all parameters were between (+, - 3)

Table (3) Mean ±, Sd., Range and Skew for (GH) and $CD34^+$ Variables (three experiment groups) (n=14)

S	Variables	Mean	SD. deviation	Range		SK
				Minimum	Maximum	
1	Stem cell(CD 34+%)	.7629	.15843	.45	.96	-.777
2	Growth Hormone (n/g)	.6114	.36319	.07	1.04	-.526
3	Stem and legs flexibility(cm)	70.4286	7.51116	60.00	85.00	.326
4	Right leg front(degree)	73.2857	4.82667	65.00	80.00	.083
5	Left leg front (degree)	63.4286	6.99136	50.00	75.00	-.661
6	Right leg back (degree)	63.8571	8.62784	50.00	80.00	.198
7	Left leg back(degree)	11.2500	2.07318	7.00	14.00	-.279

Skew Factor of all parameters were between (+, - 3)

Table (4) Clinical efficacy Form of pain degree measurement for three experimental groups (n=14)

S	Group	After First week			After Second week			After Third week		
		mild	low	non	mild	low	non	mild	low	non
1	Drug only	√			√				√	
2	Drug only	√			√				√	
3	Drug only	√				√			√	
4	Exercise only	√				√				√
5	Exercise only	√			√				√	
6	Exercise only	√				√				√
7	Exercise only	√			√				√	
8	Exercise only	√				√				√
9	Exercise with drug		√				√			√
10	Exercise with drug	√				√				√
11	Exercise with drug	√				√				√
12	Exercise with drug	√				√				√
13	Exercise with drug		√				√			√
14	Exercise with drug	√				√				√

Table(4) indicated speed of healing in favour of third experimental group (exercise with drug)

Tools and devices used:-

1. Clinical efficacy Form
2. Stopwatch.
3. Foam roller.
4. Mats.
5. Cassette and music discs.
6. Atape centimeter measurement.
7. Regular centimeter box.
8. Genometer device.
9. Test tubes.
10. Balance weight, Restameter.
11. Freezer to store the samples.
12. EDTA anticoagulant.
13. Coulter counters for blood components estimation.
14. Flow cytometer to determine CD 34+%.
15. Monoclonal antibodies against human $CD34^+$ %.
16. Vortex for shaking test tubes.
17. Cell pellet.
18. Ice box.
19. Centrifuge for separation of plasma and blood content.
20. Fluorochrome – conjugated antibodies.

Clinical analysis: Immunophenotyping $CD34^+$%. , Growth hormone (GH) n/g.

Flexibility tests: Stem and legs flexibility.

The exercise program included the following:

1 .warm-up: aims to create different organs of the body, joints and muscles to perform exercises and it included free exercises for all parts of the body and exercises using the bar.

2. Main phase: The included:-

- Foam roller exercises: Exercises Massage Using the "foam roller" for all body general and leg muscles especially.

3. Cool down: exercises to calm and relaxation, aims to return the body to normal before training.

Before the main experiment the researchers have done the following:

- Exercise program for 3 weeks (4 days / week).
-The graduation of the time of bout of exercise from 30-45 min.
- Follow the positive rest by deep respiration during the main phase of the exercise bout.

Table (5) Time destribution of exercise program

S	Phase	Time
1	Warm-up	(5 - 10) min
2	Main Phase - Exercises " foam roller " -Deep respiration exercises.	(20 - 30) min
3	Cool down	5 min

Statistical Analysis:

Researchers used statistically descriptive data, the non-parametric (Wilcoxon rank sum test) to compare between pre and post exercise program variables and with change rate %. An α level of 0.05 was used to indicate statistical significance.

Table (6) Statistical difference between pre and post measurement of first experimental group (Omega 3, 6, 9, vitaminE) alone (n=3)

S	Variables	Measure	Rank	Difference		Z value	p value
				Direct	Number		
1	Stem cell(CD 34+%)	Pre Post	2.00 0	- + =	3 0 0	-1.604	0.109
2	Growth Hormone (n/g)	Pre Post	2.00 0	- + =	3 0 0	-1.604	0.109
3	Stem and legs flexibility(cm)	Pre Post	1.50 0	- + =	 2 0	-1.342	0.180
4	Right leg front(degree)	Pre Post	0 2.0	- + =	0 3 0	-1.604	0.109
5	Left leg front (degree)	Pre Post	1.0 0	- + =	1 0 2	-1.000	0.317
6	Right leg back (degree)	Pre Post	3.0 1.50	- + =	1 2 0	0.00	1.0
7	Left leg back(degree)	Pre Post	3.0 1.50	- + =	1 2 0	0.00	1.00

Table (6) indicated no Statistical significant change between pre and post measurement.

Table (7) Change rate % of pre and post measurement of first experimental group (Omega 3, 6, 9, vitaminE) alone (n=3)

S	Variables	Mean Pre	Mean Post	Change%
1	Stem cell(CD 34+%)	.903	.723	-19.94
2	Growth Hormone (n/g)	1.013	.300	-70.39
3	Stem and legs flexibility(cm)	8.6667	7.6667	-11.53
4	Right leg front(degree)	72.0000	71.6667	-0.46
5	Left leg front(degree)	74.6667	72.6667	-2.68
6	Right leg back(degree)	72.0000	71.6667	-0.46
7	Left leg back(degree)	74.6667	72.6667	-2.68

Table (7) Showed that change rate % of pre and post measurement between (-70.39,-0.46).

Table (8) Statistical difference between pre and post measurement of second experimental group foam roller exercise alone (n=5)

S	Variables	Measure	Rank	Difference		Z value	p value
				direct	Number		
1	Stem cell(CD 34+%)	Pre Post	0 3.0	- + =	5 0 0	- 2.032 *	0.042
2	Growth Hormone (n/g)	Pre Post	0 3.0	- + =	0 5 0	- 2.032 *	0.042
3	Stem and legs flexibility(cm)	Pre Post	3.0 0	- + =	5 0 0	-2.060 *	0.039
4	Right leg front(degree)	Pre Post	0 3.0	- + =	0 5 0	-2.041 *	0.041
5	Left leg front(degree)	Pre Post	0 3.0	- + =	0 5 0	-2.041 *	0.041
6	Right leg back(degree)	Pre Post	0 3.0	- + =	0 5 0	-2.060 *	0.039
7	Left leg back(degree)	Pre Post	0 3.0	- + =	0 5 0	-2.060 *	0.039

Table (8) indicated significant change between pre and post the program in favour of post measurement.

Table (9) Change rate % of pre and post measurement of second experimental group (foam roller exercise alone) (n=5).

S	Variables	Mean Pre	Mean Post	Change%
1	Stem cell(CD 34+%)	.8040	.1440	-82.09
2	Growth Hormone (n/g)	.8040	1.3280	65.42
3	Stem and legs flexibility(cm)	12.1000	8.8000	-27.27
4	Right leg front(degree)	63.4000	69.4000	9.46
5	Left leg front(degree)	68.8000	74.4000	8.14
6	Right leg back(degree)	62.4000	66.4000	6.41
7	Left leg back(degree)	62.0000	67.8000	9.35

Table (9) Showed that change % of pre and post program between (-82.09 and 65.42).

Table (10) Statistical difference between pre and post measurement of third experimental group(foam roller exercise with (Omega 3,6,9,vitaminE) (n=6)

S	Variables	Measure	Rank	difference		Z value	p value
				direct	Number		
1	Stem cell(CD 34+%)	Pre Post	**3.50 0**	**- + =**	**6 0 0**	**-2.207 ***	**0.027**
2	Growth Hormone (n/g)	Pre Post	**0** 3.50	**- + =**	**0 6 0**	**-2.201 ***	**0.028**
3	Stem and legs flexibility(cm)	Pre Post	**3.50 0**	**- + =**	**6 0 0**	**-2.220 ***	**0.026**
4	Right leg front(degree)	Pre Post	**0** 3.50	**- + =**	**0 6 0**	**-2.271 ***	**0.023**
5	Left leg front(degree)	Pre Post	**0** 3.50	**- + =**	**0 6 0**	**-2.449 ****	**0.014**
6	Right leg back(degree)	Pre Post	**0** 3.50	**- + =**	**0 6 0**	**-2.271 ***	**0.023**
7	Left leg back(degree)	Pre Post	**0** 3.50	**- + =**	**0 6 0**	**-2.220 ***	**0.026**

Table (10) indicated significant change between pre and post in all variables in favour of post measurement

Table (11) Change rate % of pre and post measurement of third experimental group (foam roller exercise with (Omega 3,6,9,vitamin E) (n=6).

S	**Variables**	**Mean Pre**	**Mean Post**	**Change%**
1	Stem cell(CD 34+%)	**.6583**	**.1450**	**-77.96**
2	Growth Hormone (n/g)	**.2500**	**6.3250**	**2432**
3	Stem and legs flexibility(cm)	**12.1000**	**8.8000**	**-27.27**
4	Right leg front(degree)	**71.0000**	**79.3333**	**11.73**
5	Left leg front(degree)	**75.0000**	**80.0000**	**6.67**
6	Right leg back(degree)	**60.0000**	**73.3333**	**22.22**
7	Left leg back(degree)	**60.0000**	**71.6667**	**19.45**

Table (11) Showed that change % of pre and post program between (-77.96 , 2432).

3. Results and Discussion:

Strenuous exercise is accompanied by a sequential increase in circulating pro inflammatory and inflammation response cytokines (Pedersen et al, 1998). The immune system alterations probably contribute to the pathogenic tissue changes observed in sports persons during competition (Cordova et al, 2006). It is possible that preventing the immune disturbances following sport activity might limit subsequent tissue damage. Smith (1991) suggested that acute inflammatory processes may be the underlying mechanism of exercise- induced muscle damage (Nosaka and Clarson, 1996).Since inflammation appears to play an important role in the pathogenesis of muscular damage induced by continuous and maintained exercise, many studies have attempted to evaluate the ability of non-steroidal anti-inflammatory agents or steroidal agents in reducing the biochemical signs of muscular injury.

In the present study, injury was accompanied by decreases in percent of $CD34^{+}$ in all three injured groups compared to control group. Ewa and Pawer (2007) indicated that the counts of EPCs in the peripheral blood and their proliferation can change under various conditions: Pathological stages, including diabetes, smoking, c-reactive protein and vascular disease reduce stem cell counts . However, factors including physical exercise, estrogen,

erythropoetin, statins, vascular endothelial growth factor and stromal derived factor (SDF_1) increase EPC count and function.

Asaf Spiegel et al, (2008) reported the mechanism leading to increase stem cell in the blood due to stress induced by injury, bleeding or high intensity exercise enhance release of catecholamines and SDF_1 levels and their receptors in bone marrow . In addition ,these stress conditions trigger expansion and activation of osteoclasts , and the release of various proteolytic enzymes enabling the robot mobilization of HPCs from the bone marrow to the blood stream to participate in host defence and organ repair.

The decreased $CD34^+$ % reported in this study, might participate in muscle repair and healing process after muscle injury.

Patrick et al, (2008) reported that satellite cells in muscle have only a limited capacity for self renewal, which means that under pathological conditions skeletal muscle degenerates. The origin of satellite cells is unclear. They express M-Cadherin (M-Cad) and N-Cam, and co-express myogenic factors such as growth factors. They also express some endothelial cell markers (De Angelis et al, 1999). It has been shown that a stem cell fraction in bone marrow can provide skeletal muscle progenitors (Ferrari et al, 1998).

This again prove the participation of $CD34^+$ % reported in this study in muscle repair through its involvement in providing skeletal muscle progenitors and help in healing process.

Table (8,10) indicated a significant decrease in $CD34^+$% in the second and third experimental groups (exercise alone and the use of both Omega 3,6,9,vitaminE and exercise),table (6) indicated non significant decrease in drug alone (Omega 3,6,9,vitaminE) After the different administrations.Table (9,11) indicated improve in $CD34^+$ change rate for the favour of post measurement in second experimental group (-82.09%) and third experimental group (-77.96%) .

The decreased $CD34^+$ % noted might be caused, that a stem cell fraction in bone marrow can provide skeletal muscle progenitors in different degrees according to the method used: a drug or therapeutic exercises or both Omega 3,6,9 and exercises.

A number of studies have shown that exercise or/ and drugs improve the function and regeneration of the cardiovascular system and skeletal muscle by activating and mobilizing organ resident stem cells (Crameri et al, 2007). Or by recruiting blood-circulating stem cell or progenitor cells (Adams et al, 2004). Exercise provokes a number of stimuli: mechanical, metabolic and hypoxic. It also induces the release of various growth factors cytokines and hormones. Physical activity results in the induction of molecular adaptations that improve physical performance, fitness and / or health whether under power sports conditions or situations of leisure sport, prevention or rehabilitation. This implies growth process must occur for heart and muscle cells.

Our data revealed in table (6) , indicated that the growth hormone non significantly increased in drug alone between pre and post measurement .

Barret et al, (2010) stated that the understanding of the mechanism of action of growth hormone has evolved recently as new information has become available. Growth hormone was originally thought to produce growth by a direct action on tissues, then later was believed to act solely through its ability to induce somatomedins. However, if growth hormone is injected into one proximal tibial epiphysis, a unilateral increase in cartilage width is produced and cartilage, like other tissues, makes $IGF\text{-}_1$. A current hypothesis to explain these results holds that growth hormone acts on cartilage to convert stem cells into cells that respond to $IGF\text{-}_1$ and then locally produced and circulating $IGF\text{-}_1$ makes cartilage grow. Overall, it seems that growth hormone and somatomedins can act both in cooperation and independently to sitmulate pathways that lead to growth.

Studies performed in injured persons suggested that diet supplementation with Omega3,6,9 fatty acids, display significant anti-inflammatory and anti-thrombotic properties (Blok et al, 1996).In high concentrations they contribute to the formation of thrombi and the development of inflammatory disorders (Simopulos,2003).

They must be taken in proper doses to prevent the negative action.

Concerned the anti-inflammatory effect of Omega 3,6,9 the present study indicated a contribution to muscle healing in both groups receiving the drug alone or in conjugation with physical exercise .As for the effect of growth factors in muscle healing.

Menetrey et al, (2000) reported that growth factors are small peptides which bind to membrane receptors to influence the various steps of the growth and development of cells through several signaling pathways. It has already been shown that they are capable of stimulating the growth and protein secretion of many musculoskeletal cells. Trippel et al, (1996) stated that during muscle regeneration, it is presumed that trophic substances released by the injured muscle activate the satellite cells and that growth factors play a specific role during muscle regeneration and that growth hormone stimulate $IGF\text{-}_1$ and some growth factors therefore may improve muscle healing.

Growth hormone concentration (table 8,10) significantly increased after the different protocols used in case of the two groups of training alone or plus drug as a measure of hastening muscle regeneration, except (table 6) in case of using Omega 3,6,9,vitaminE alone, growth hormone exhibit a lower concentration . Table(9,11) indicated improve in growth hormone change rate favour post measurement in second experimental group(65.42%) and third experimental group(2432%) .

This result was in accordance with that of Guyton and Hall (2006), they stated that growth hormone is secreted in a pulsatile pattern , increasing and decreasing, they also stated that there are several factors related to a persons state of nutrition or stress are known to stimulate secretion (1) exercise (2) trauma (3) excitement and that growth hormone attaches only weakly to the plasma proteins in the blood. Therefore, it is released from the blood into the tissues rapidly, having a half time in the blood of less than 20 minutes.

Muscle injury and repair involve a complex balance between local muscle fibre repair, regeneration and scar tissue formation (Beiner and Joke 2001). A variety of methods have been examined for the purpose of hastening muscle regeneration in order to restore muscle function, by either enhancing muscle fibre growth and regeneration or promoting vascularity and nerve repair.

Anti-inflammatory medications, corticosteroids, surgical methods and exercise protocol have been studied (Jarvinen et al, 2007, sato et al, 2003).In this study, Omega 3,6,9 has been used alone or together with exercise so as to improve muscle regeneration that is important for hastening muscle repair and restoring muscle function. So as to offer considerable promise for treating muscle damage. (table 4) indicated that to assess the clinical efficacy of the different applications, the exercise plus Omega 3,6,9,vitaminE treatment resulted in a rapid speed of healing followed by exercise alone and at the end was the drug alone(Omega 3,6,9,vitaminE) treatment . This occurs after injury, muscle healing and repair passes through different phases, including (1) degeneration and inflammation (2) muscle regeneration and (3) development of fibrosis, and that enhancement of muscle regeneration through exercise and drug (Omega 3,6,9,vitaminE), and prevention of muscle fibrosis can improve muscle healing.

Conclusion:

It may be concluded that:

-Growth Hormone (GH) increased in the second and third experimental group after the program.

- The decreased stem cell CD34+ % indicated a sharing in improvement of healing.
- The increase of flexibility variables indicated a positive effect of foam roller exercise, drug (Omega 3,6,9,vitaminE) of the specificity principle applied, taking account the individual variations.

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