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Complex Medical Rehabilitation for Cancer-related Lower Limbs Lymphedema: a Prospective Comparative Randomized Study of 60 Patients

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ABSTRACT

INTRODUCTION. The management of patients with secondary lymphedema of the lower extremities associated with radical treatment of pelvic cancer (Cancer Related Lymphedema) is extremely problematic due to persistent impairment of the draining function of regional lymph nodes due to intraoperative dissection and subsequent radiation therapy.

AIM. To compare the effectiveness of complex medical rehabilitation using the kinesio taping method and innovative non-stretchable compression bandages in patients with secondary lymphedema of the lower extremities associated with radical treatment of pelvic cancer.

MATERIAL AND METHODS. The study involved 60 patients with stages I-III Cancer Related Lymphedema (according to the classification of Savchenko T.V., Pokrovsky A.V., 2004) who underwent radical treatment for various forms of pelvic cancer (gynecological cancer in women and prostate cancer in men), randomized into 2 groups (30 people each). A comprehensive rehabilitation was carried out in the main group (n=30), including sequential manual lymphatic drainage, skin care, kinesio taping, therapeutic gymnastics in the gym; Adjustable Non-stretchable Compression Bandages ("circaid juxtafit", Germany). Meanwhile, a Complex Decongestive Therapy was performed in the comparison group (n=30), which is considered as the "gold" standard of conservative treatment of lymphedema of the lower extremities, including manual lymphatic drainage, skin care, Multi-layered limb banding using Inelastic compression Bandages. In order to evaluate the anti-edematous effect the dynamics of the circumferences of the lower extremities, waist circumference and hip circumference, the Ankle Range of Motion were examined using goniometry, bio-impedancemetry. Laser Doppler Flowmetry was used to evaluate microcirculatory parameters.

RESULTS AND DISCUSSION. There was a decrease in swelling and thickening of the skin in the thigh, a decrease the external genitalia edema in patients with Cancer Related Lymphedema in both groups after a course of rehabilitation. There was a regression of swelling of the feet and lower legs in patients of both groups ($p<0.05$) after treatment, which was confirmed by a decrease in the circumferences of the lower limbs. There was an increase in the Ankle Range of Motion (dorsiflexion) from 17.50±1.26° to 19.25±1.52° ($p<0.05$) in the main group and from 17.90±1.44° to 18.59±1.10° ($p<0.05$) in the comparison group. According to the bio-impedancemetry data, there was a decrease in the extracellular fluid content both in the main group and the comparison group by 2.64% and 2.83%, ($p<0.05$) respectively. There was also a comparable decrease in the total fluid content by 2.67% in the main group and 1.90% ($p<0.05$) in the comparison group. There were a decrease in body weight by 2.49% and 1.52% ($p<0.001$), a decrease in fat mass by 2.62% and 4.01% ($p<0.05$) in both groups respectively after the course of treatment. According to the Laser Doppler Flowmetry data, there were an improvement in the indicators of myogenic tone of arterioles and secretory activity of the endothelium, as well as elimination of venular congestion in patients of both groups ($p<0.05$).

CONCLUSION. Regression of edema in Cancer Related Lymphedema can be achieved as a result of the use of manual lymphatic drainage which stimulates the outflow of lymph through lymphatic "watersheds" into adjacent lymphatic territories with intact regional lymph nodes, which was achieved in both groups. The lymphatic drainage effect of manual lymphatic drainage was supported by the daily compression profile of bandages (Multi-layered Inelastic Bandages and Adjustable Non-stretchable Compression Bandages) in patients of both groups. Our study showed that the use of kinesio tapes leveled the difference in compression of approximately 10-15 mmHg between the bandages used (50 mmHg/~60 mmHg).

KEYWORDS: lymphedema, lower extremities, pelvis cancer, prostate cancer, kinesio taping, compressive

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Комплексная медицинская реабилитация при раковой лимфедеме нижних конечностей: проспективное сравнительное рандомизированное исследование 60 пациентов

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РЕЗЮМЕ

ВВЕДЕНИЕ. Ведение пациентов с вторичной лимфедемой нижних конечностей, связанной с радикальным лечением рака органов малого таза (лимфедемой, связанной с лечением рака), является крайне проблематичным за счет стойкого нарушения дренирующей функции регионарных лимфатических узлов, обусловленной интраоперационной диссекцией и последующей лучевой терапией.

ЦЕЛЬ. Сравнительное изучение эффективности комплексной медицинской реабилитации с применением метода кинезиотейпирования и инновационных нерастяжимых компрессионных бандажей у пациентов с вторичной лимфедемой нижних конечностей, связанной с радикальным лечением рака органов малого таза.

МАТЕРИАЛ И МЕТОДЫ. В исследование включено 60 пациентов с лимфедемой, связанной с лечением рака I-III стадий (по классификации Савченко Т.В., Покровского А.В., 2004), перенесших радикальное лечение по поводу различных форм рака органов малого таза (гинекологический рак у женщин и рак простаты у мужчин), рандомизированных на 2 группы (по 30 человек). В основной группе (n=30) проводилась комплексная реабилитация, включающая последовательно мануальный лимфодренаж, уход за кожей, кинезиотейпирование, лечебную гимнастику в зале; регулируемые нерастяжимые компрессионные бандажи («circaid juxtafit», Германия). В группе сравнения (n=30) проводилась комплексная противоотечная терапия, являющаяся «золотым» стандартом консервативного лечения хронических лимфатических отеков нижних конечностей, включающая мануальный лимфодренаж, уход за кожей, многослойное бандажирование конечностей с помощью низкорастяжимых компрессионных бинтов. Для оценки противоотечного эффекта изучалась динамика показателей окружностей нижних конечностей, окружностей талии и окружностей бедер, диапазона движений в голеностопном суставе с использованием гониометрии, биоимпедансометрии. Для оценки микроциркуляторных показателей применялась лазерная допплеровская флоуметрия.

РЕЗУЛЬТАТЫ И ОБСУЖДЕНИЕ. У пациентов с лимфедемой, связанной с лечением рака в обеих группах после проведенного курса реабилитации отмечено уменьшение отеков и уплотнение кожи в области бедра, уменьшение отеков наружных половых органов. После лечения отмечалась регрессия отеков стоп и голеней у пациентов обеих группы ($p<0,05$), что проявлялось уменьшением окружностей нижних конечностей. Отмечено увеличение диапазона движений в голеностопном суставе (дорсифлексии) с 17,50±1,26° до 19,25±1,52° ($p<0,05$) в основной группе и с 17,90±1,44° до 18,59±1,10° ($p<0,05$) в группе сравнения. По данным биоимпедансометрии произошло снижение содержания внеклеточной жидкости в основной группе и группе сравнения – на 2,64% и 2,83%, ($p<0,05$), соответственно. Отмечено также сопоставимое снижение содержания общей жидкости на 2,67% и 1,90% ($p<0,05$) в основной группе и группе сравнения. В обеих группах после курса лечения произошло снижение массы тела – на 2,49% и 1,52% ($p<0,001$), снижение жировой массы – на 2,62% и 4,01%($p<0,05$), соответственно. По данным лазерной допплеровской флоуметрии отмечены улучшение показателей миогенного тонуса артериол, секреторной активности эндотелия, ликвидация венулярного застоя у пациентов обеих групп ($p<0,05$).

ЗАКЛЮЧЕНИЕ. Регрессии отеков при лимфедеме, связанной с лечением рака возможно добиться в результате применения мануального лимфедренажа, стимулирующего отток лимфы через лимфатические «водоразделы» в сопредельные лимфатические территории с интактными регионарными лимфатическими узлами, что и было достигнуто в обеих группах. Лимфодренажный эффект мануального лимфедренажа поддерживался суточным компрессионным профилем бандажей (многослойные низкорастяжимые бандажи и регулируемые нерастяжимые компрессионные бандажи) у пациентов обеих групп. Применение кинезиотейпов нивелировало разницу в компрессии около 10-15 мм рт.ст. между применяемыми бандажами (50 мм рт.ст./~60 мм рт.ст.), что и показало наше исследование.

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INTRODUCTION

The development of personalized programs of conservative treatment and rehabilitation of patients with chronic lymphatic edema of the lower limbs is currently one of the urgent tasks of restorative medicine due to the high prevalence of the disease and low effectiveness of treatment. Chronic lower extremity lymphatic edema (LLE) affects up to 140-250 million people worldwide [1]. The share of chronic lymphatic edema of the lower extremities accounts for about 10% in the general structure of vascular pathology, according to various authors [2, 3].

Over the past decades, there has been a steady increase in the number of patients with secondary lymphedema in developed countries who have undergone surgical treatment with dissection of regional lymph nodes and radiation therapy for various forms of gynecological cancer in women and prostate cancer in men. Thus, 17% of patients with cervical cancer and 36% of patients with vulvar cancer develops Cancer Related Lymphedema after treatment of gynecological cancer with dissection of lymph nodes after 12 months [4]. In the USA, malignant neoplasms of the pelvic organs and associated radical treatment (surgical intervention with dissection of lymph nodes and radiotherapy) are the most common cause of the secondary lymphedema of the lower extremities [5]. Scars and adhesions develop during intraoperative dissection of regional lymph nodes in radical surgery for cancer, reducing and blocking lymphatic drainage. Subsequent radiation therapy of the lymph node area causes further damage and scar formation, which significantly complicate lymph flow and lead to manifesting lymphatic edema [6, 7]. It has been shown that dissection of lymph nodes in malignant melanoma increases the risk of lymphedema by up to 80%, although some studies suggest that the frequency of occurrence is from 6 to 29%, and when radiation therapy is involved – from 5 to 49% [8]. The risk of developing Cancer-Related Lymphedema (CRL) ranges from 3 to 8% in prostate cancer, and increases by 3-4 times when using post-operative radiation therapy [6, 9].

In ICD – 11, this clinical form of LLE is isolated into an independent nosological form and has the code BE1B – Lymphedema due to surgery or radiation therapy (Grade 11) [10]. In international scientific databases, this name corresponds to the definition of Cancer-Related Lymphedema.

The management of patients with CRL is extremely problematic [11]. Some peculiarities in the management of such patients include an unfavorable prognosis associated with the progression of edematous syndrome, a large range of contraindicated physio-balneotherapeutic factors associated with a high risk of metastasis of the underlying disease with their active use (thermal, stimulating lymphatic drainage techniques, mineral baths, cryotherapy). The psychological status is aggravated by depressive syndrome, asthenia and a decrease in general and local immune responses in patients with CRL, who underwent adjuvant treatment [12]. This affects the behavior of patients, causes increased lability, low compliance, distrust for doctor's recommendations [9, 13]. Some patients feel unable to control the edema and develop a fatal attitude when they cease supportive compression measures. Nevertheless, the steady growth of patients with this type of edema requires the creation and testing of rehabilitation protocols with clear criteria for indications and contraindications to specific methods used. Both the attending physician and the patient should be clearly aware that supportive compression decongestant treatment for this type of lymphedema should be applied continuously, lasting 24 hours a day, 7 days a week, 12 months a year [14, 15]. It is necessary to argue the effectiveness and safety of the use of innovative lymphatic drainage methods (aquatherapy, kinesio taping) in this group of patients [16-18]. Testing of innovative compression means – Adjustable Non-stretchable Compression Bandages (ANCB) is required with Velcro technology, designed to improve the quality of life of patients and their adherence to treatment [19, 20].

AIM

This is a comparative study of the effectiveness of complex medical rehabilitation using the kinesio taping method and innovative non-stretchable compression bandages in patients with secondary lymphedema of the lower extremities associated with radical treatment of pelvic cancer.

MATERIAL AND METHODS

The study involved 60 patients with stages I-III CRL (according to the classification of Savchenko T.V., Pokrovsky A.V.) [21], who underwent radical treatment for various forms of pelvic cancer (gynecological cancer in women and prostate cancer in men), randomized into 2 groups (30 people each).

The stratification of the patients studied in the main group and the comparison group by age, sex, duration and severity of the disease is shown in Table 1.

Table 1. *Stratification of patients studied in the main group and the comparison group by age, gender, duration and severity of the disease*

Groups of patients	Age, yr	Sex	Height, cm	Body weight, kg	BMI, kg/m^2	Duration of the disease, yr
Main group (n=30)	57,83± 10,68	m.- 3 f. -27	166,38± 6,63	78,35± 13,58	28,87± 4,64	5,06± 2,86
Comparison group (n=30)	56,46± 11,06	m. – 3 f. – 27	165,67± 5,94	79,77± 6,68	29,28± 2,13	4,66± 2,32

Bilateral edema of the lower extremities was noted in 2 patients, which amounted to 3.3%, unilateral edema of the lower extremities was noted in other cases (96.3%). The features of edema in CRL are as follows: unilateral nature, predominance of localization in the hip area, increased density of subcutaneous tissue during palpation (non-pitting lymphedema), lack of regression after a night's rest, predominance of lesions of the proximal etremities (hip, knee) in the early stages of the disease.

The distribution of patients by clinical stages of the disease is presented in Table 2.

Table 2. *Distribution of patients with lymphedema of the lower extremities by clinical stages of the disease (classification Savchenko T.V., Pokrovsky A.V., 2006) (abs/%)*

Clinical stages of lymphedema	Main group (n=30)	Comparison group(n=30)
II stage	5 (16,7%)	8 (26,7%)
III stage	25 (83,3%)	22 (73,3%)

In the main group (30 people), a comprehensive rehabilitation was carried out, including sequential manual lymphatic drainage (MLD), skin care, kinesio taping, therapeutic gymnastics (TG) in the gym; Adjustable Non-stretchable Compression Bandages (ANCB "circaid juxtafit", Germany). In the comparison group (30 people), a Complex Decongestive Therapy (CDT) was performed, which is considered as the "gold" standard of conservative treatment of LLE, including MLD, skin care, multi-layered limb banding using inelastic compression bandages (MLIB).

The following research methods were used to assess the effectiveness of medical rehabilitation after treatment: an anthropometric method of measuring the circumferences of the lower extremities from the lower and middle thirds of the lower leg, middle and upper thirds of the thigh, waist circumferences (WC) and hips circumferences (HC) before and after the course of treatment.

Ankle goniometry was used to determine the dynamics of the ankle range of motion indicators (dorsiflexion/plantar flexion).

The bioimpedance measurement (BIM) method was used to study the distribution of body composition and quantify edema and adipose tissue in the body using ABC-02 "Medass" body composition analyzer ("MEDASS", Moscow, Russia).

The study of microcirculation was conducted using the method of laser Doppler flowmetry (LDF) with "LAKK-02" device (LAZMA, Russia).

RESULTS AND DISCUSSION

Positive dynamics of clinical manifestations of the disease was noted in patients with CRL in both groups after a course of rehabilitation: a slight decrease in severity, fatigue in the affected limb in the evening, a significant decrease in swelling and compaction of the skin in the thigh area, a decrease in edema of the external genitalia.

The study of the dynamics of edema of the lower extremities showed that initially in both the main group and the comparison group the circumferences of the lower legs and thighs were comparable and averaged: the malleolar circumference – 26.28±3.41 cm and 26.14±2.57 ($p>0.05$); the upper third of the thigh – 61.04±7.59 cm and 59.78±6.46 cm ($p>0.05$), respectively.

After the treatment, there was a significant positive dynamics of regression of edema of the feet and lower legs in patients of the main group and the comparison group ($p<0.05$), which was manifested by a decrease in the circumferences of the lower extremities (Table 3).

There was a significant decrease in asymmetry in the lower third of the lower leg compared to the intact limb by 57.03% ($p<0.001$), a significant decrease in malleolar volume, limb circumferences at the level of the middle third of the lower leg, middle and upper thirds of the thigh from 5.47% to 10.09% ($p<0.001$) in the patients of the main group.

After a course of CDT, the patients in the comparison group showed regression of edema in the lower and middle third of the lower legs, middle and upper thirds of the thigh from 5.38% to 9.35% ($p<0.001$), a decrease in limb asymmetry at the level of the lower third of the lower leg by 56.64% ($p<0.001$).

Table 3. *Dynamics of regression of edema of the lower legs in the patients with CRL after a course of rehabilitation, cm (M±SD)*

Anthropometric indicators of the lower extremities (circumference), cm	Main group (n=30)			Comparison group (n=30)		
	Before treatment	After treatment	Δ, %	Before treatment	After treatment	Δ, %
Maleolar circumference, cm	26,28±2,65	23,80±3,18*	-9,44	26,14±2,57	24,0±3,12 *	-8,19
Middle third of the lower leg, cm	43,33±4,14	38,96±3,78**	-10,09	43,02±3,88	39,0±3,72 **	-9,35
Middle third of the thigh, cm	57,81±5,67	54,65±4,98**	-5,47	57,13±5,64	54,06±4,89 **	-5,38
Upper third of the thigh, cm	59,78±6,46	55,71±5,81**	-6,81	61,04±7,59	57,42±6,57 **	-5,94
Asymmetry in lower third of the lower leg, cm	6,19±1,67	2,66±0,97 **	-57,03	6,25±1,59	2,71±0,91 **	-56,64

Note: ** $p<0.05$; ** $p<0.001$ – the reliability of the differences in the average values compared to the initial indicators*

The study revealed the absence of significant differences in the dynamics of anthropometric indicators after the treatment in both groups. Initially, the functional insufficiency of the lower leg muscular venous pump (MVP) was revealed in patients with CRL due to a limited Ankle Range of Motion, as evidenced by a decrease in dorsiflexion and plantar flexion compared with age-related normative values and intact limbs.

Under the influence of the rehabilitation course, an increase in the range of active movements in the ankle joint was noted in the patients of the main group: the range of flexion (dorsiflexion) of the foot (DF) increased from 17,50±1,26° to 19,25±1,52° (p<0.05), the range of plantar flexion of the foot (PF) increased from 38,93±3,49 ° to 40,13±3,09 ° (p<0,05). There was an increase in the ankle range of motion in the patients of the comparison group from 17,90±1,44° to 18,59±1,10° (p<0.05) with a dorsiflexion, from 38,15±3,00° to 39,59±2,87° (p>0.05) with a plantar flexion respectively (Table 4).

Table 4. *Dynamics of goniometry (dorsiflexion, plantar flexion) of the ankle joint in patients with CRL, (M±SD)*

Indicator	Main group (n=30)		Comparison group (n=30)	
	Before treatment	After treatment	Before treatment	After treatment
Plantar flexion, PF, degrees	38,93±3,49	40,13±3,09*	38,15±3,00	39,59±2,87
Dorsiflexion AROM, DF, degrees	17,50±1,26	19,25±1,52*	17,90±1,44	18,59±1,10*

Note: *AROM is Ankle Range of Motion, * p<0.05 – the reliability of differences compared to the indicators before treatment*

The patients of the main group demonstrated a significant dynamics of dorsiflexia indicators were revealed due to a more pronounced regression of edema in the distal extremity (foot and lower third of the lower leg) and MVP of the lower leg, which promotes increased performance when walking.

The proposed rehabilitation complex, including MLD, kinesio taping, TG in the gym and ANCB was accompanied by an improvement in ankle joint mobility in patients with CRL due to a more pronounced regression of distal and proximal edema.

After the rehabilitation course, the patients of both groups showed a significant decrease in such indicators of bioimpedance measurement (BIM) as the content of total fluid (TF), extracellular fluid (ECF), body weight, fat mass (FM), lean mass (LM), waist/hip index (Table 5).

Table 5. *Dynamics of bioimpedance parameters of patients with CRL before and after treatment, (M±SD)*

Bioimpedance parameters	Main group (n=30)		Comparison group (n=30)	
	Before treatment	After treatment	Before treatment	After treatment
Body weight, kg	78,35±13,58	76,40±12,50**	79,77±6,68	78,56±5,99**
BMI, kg/m^2	28,87±4,64	28,08±4,17**	29,28±2,13	28,84±2,04*
Waist/Hip index	0,87±0,07	0,84±0,08*	0,88±0,08	0,85±0,06*
Phase angle, degrees	6,48±0,86	6,54±0,72	6,26±0,67	6,37±0,73*
Fat mass, %	32,90±8,68	32,04±8,67*	33,7±8,74	32,35±7,98*
Lean weight, kg	53,35±7,56	52,63±7,11*	53,87±4,94	52,78±5,12*
Active cell mass, kg	29,32±5,10	29,07±5,05	29,88±3,73	29,72±3,65
Musculoskeletal mass, %	23,33±4,27	23,0±3,84	23,73±2,78	23,45±2,80
Total fluid, kg	39,06±3,48	38,02±3,26*	39,11±5,45	38,37±5,23*
Extracellular fluid, kg	16,31±1,98	15,88±1,79*	16,64±1,23	16,17±1,19*

Note: ** p<0.05; ** p<0.001 – the reliability of differences in average values compared to the initial indicators*

The dynamics of body composition indicators according to the BIM data indicated a pronounced decongestant effect of the rehabilitation complexes used, as evidenced by a decrease in extracellular fluid content in the main group and the comparison group by 2.64% and 2.83%, (p<0.05) respectively. There was also a comparable decrease in the total fluid content by 2.67% in the main group and 1.90% (p<0.05) in the comparison group.

In both groups, there was a decrease in body weight by 2.49% and 1.52% (p<0,001) respectively. There was also a decrease in fat mass after the rehabilitation course by 2.62% and 4.01% (p<0.05) respectively.

The obtained data confirmed the effective decongestant effect of the complexes used in both groups, which was also accompanied by a lipolytic effect due to stimulation of lipolysis and mobilization of fat depots. The lymphatic drainage effect of MLD was effectively supported by ANCB bandage systems with a pressure of ~50 mmHg.

Spastic type of microcirculation was determined in all patients with CRL before treatment according to LDF data (wavelet transform) (Table 6).

An increase in neurogenic (NT) and myogenic tone (MT) of arterioles, a decrease in the level of endothelial oscillations were revealed. An increase in the Ac/3 σ x 100% was found, which confirmed the presence of stagnant phenomena at the level of the precapillary link of the microcirculatory bed. Minor changes in the venular link were revealed.

The microcirculation index (MI) was below normal values, which indicated a spasm of the fetal vessels.

After a course of rehabilitation, the patients in the main group revealed: an increase in the index of endothelial (E), neurogenic (N), myogenic (M) and respiratory (R) oscillations, a decrease in myogenic tone (MT) and neurogenic tone (NT), indicating a decrease in the initially increased tone of arterioles ($p<0.05$), a decrease in stagnation in the capillary link, correction of endothelial dysfunction.

An increase in endothelial (E) and neurogenic (N) oscillations were found in the patients of the comparison group indicating an improvement in the functional activity of the endothelium. There was a trend towards a decrease in respiratory (R) oscillations, in myogenic tone (MT) and neurogenic tone (NT), indicating a decrease in the initially increased tone of arterioles ($p<0.05$).

The findings indicate that the proposed complex in the main group led to a significant positive effect on the myogenic tone of arterioles, secretory activity of the endothelium and the elimination of venular stagnation due to the synergistic lymphatic drainage action.

Table 6. *Dynamics of laser Doppler flowmetry indicators according to wavelet analysis in patients with CRL before and after rehabilitation (M=SD)*

Indicator	Main group (n=30)		Comparison group (n=30)	
	Before treatment	After treatment	Before treatment	After treatment
E-Amax/3σx 100%	8,55±2,61	13,18±3,81**	8,78±3,26	13,13±3,65**
N-Amax/3σx 100%	9,91±5,18	13,79±5,83*	9,97±5,40	12,99±4,36*
M-Amax/3σx100%	8,44±4,51	11,07±5,54*	8,34±4,34	10,14±4,15
R-Amax/3σx 100%	5,78±4,13	8,02±4,42*	5,89±4,03	7,47±3,88
C-Amax/3σx 100%	7,38±5,38	7,33±3,06	6,88±5,32	7,55±3,20
NT	4,35±2,37	3,09±1,90*	4,38±2,38	2,86±1,38*
MT	5,63±3,70	3,98±2,34*	5,27±2,80	3,45±2,24*
BP	1,25±0,28	1,33±0,42	1,23±0,48	1,26±0,39

Note: ** p<0.05; ** p<0.001 – the reliability of the differences in the average values compared to the initial indicators*

The study of microcirculation indicators in patients with CRL in the comparison group revealed a significant improvement in endothelial and neurogenic fluctuations, a decrease in increased myogenic and neurogenic tone of arterioles, which also led to an improvement in the secretory activity of the endothelium under the influence of CDT. Thus, the CDT technique have a pronounced microcirculatory effect along with the decongestant effect due to a decrease in interstitial ultrafiltration and an improvement in venous and lymphatic outflow from the lower extremities in CRL.

CDT includes the use of MLIB with a target pressure of ~60 mmHg and high rigidity (SSI=20-30 mmHg) [22, 23], which is accompanied by a significant restriction of movement in the ankle joint due to the creation of a cylindrical profile of the bandage using pelots and volumetric lymphatic polyurethane pads in the area of internal and external ankles, restricting movement when walking. The use of MLIB also requires the participation of a specialist, who has been trained for the application technique in authorized clinics, as it is a highly operator-dependent technique [23].

In previous studies, it was found that the use of ANCB "circaid juxtafit" has a number of advantages over the use of MLIB: they create a target compression pressure of 50 mm Hg, which can be adjusted by the patient himself using a special scale, have high rigidity, do not lose the target pressure level due to the ability to reconfigure the bandage system independently at any time of the day, without consulting a specialist [24, 25].

Adequate physical activity is recommended to all patients with LLE in the form of daily long-term walking. Interval aerobic exercise should be carried out under the condition of mandatory compression support. At the same time, an adequate compression profile, maintaining the correct walking pattern, minimizing the limitation of the ankle range of motion, limiting the activity of muscle pumps should be a prerequisite. The mobility of the ankle joint in combination with a competent muscle pump of the lower leg with the safety of the valves of the venous system provides a full-fledged lymphatic and venous outflow from the lower extremities [26].

In an earlier study, it was found that the use of MLIB, which is an obligatory component of CDT, leads to an increase in the efficiency of the lower leg MVP along with the decongestant effect, which is confirmed by an increase in the average extension force, the maximum extension force but limits the AROM (dorsiflexion) by 47% of the initial indicator. The use of an alternative decongestant method of ANCB compression also increases the performance of the muscle pump. It increases the average extension force, the maximum extension force, while the restriction of the AROM occurs only by 20% [27].

ANCB is not inferior to traditionally used MLIB for the treatment of LLE, not only in decongestant action but also in improving the performance of the muscle pump. At the same time, its negative impact on the limitation of the AROM is much less pronounced than the MLIB.

CONCLUSION

The experience in treating patients with CRL shows that edema in this form of LLE is difficult to regress and subsequent control [11]. Regression of edema in CRL can be achieved as a result of the use of MLD, which stimulates

the outflow of lymph through lymphatic "watersheds" into adjacent lymphatic territories with intact regional lymph nodes, which was achieved in both groups. The use of the kinesio taping method in patients of the main group allowed to consolidate the effect of MLD, since the anchors of the tapes were superimposed in the projection of functioning lymph nodes, and the strips of tapes along the lymph vessels of the limb for 24 hours. Thus, the lymphatic drainage was maintained through lymphatic "watersheds" to adjacent lymphatic territories during the day.

The effect of MLD was also supported by the daily compression profile of bandages (MLIB and ANCB) in patients of both groups. The use of kinesio tapes leveled between the bandages used (50 mmHg/~60 mmHg), which our study showed.

ANCB compression bandages can be recommended to patients with CRL as an alternative to the traditionally used MLIB bandages in the intensive and supportive phases of CDT, with the possibility of replacing ANCB at night with "night" garments with a low pressure profile (~15 mmHg) and massaging built-in foam channels, due to the content of crushed polyurethane foam. When using ANCB, the patients with CRL have the opportunity to take daily hygiene procedures, which they are deprived of when using MLIB, which may increase the patients' compliance with the compression therapy.

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