Patologie osteoarticolari e muscolo-scheletriche

Il trattamento con campi elettromagnetici ultradeboli migliora significativamente la mobilità articolare e riduce il dolore: Studio in 148 soggetti affetti da patologie osteo-articolari

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Introduzione: Il sistema LIMFA® Therapy è un dispositivo elettromedicale che genera informazioni e le trasmette ai recettori cellulari al fine di attivare e/o accelerare i processi endogeni di guarigione, riparazione e rigenerazione cellulare. Limfa® Therapy è un trattamento innovativo che agisce come una sorta di FARMACO ELETTRONICO.

La maggior parte degli studi che ne hanno riportato l'efficacia, mostrano un effetto analgesico, antiflogistico e antiedemigeno senza generare alcun effetto collaterale e secondario.
Scopo dello studio: determinare l'efficacia di Limfa® Therapy nella riduzione del dolore nelle patologie osteoarticolari e muscolo-sche-letriche, oltre che alla riduzione della flogosi e l'aumento della mobilità articolare.

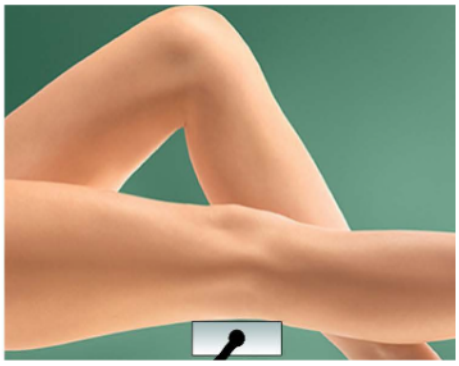
Materiali e metodi: Un gruppo di 148 soggetti adulti, affetti da varie patologie di interesse ortopedico, è stato sottoposto a Limfa® Therapy con i protocolli pre-stabiliti in relazione alle patologie presentate. I tempi e le modalità di applicazione sono standardizzati e precaricati nella macchina e, pertanto, non modificabili dall'operatore.

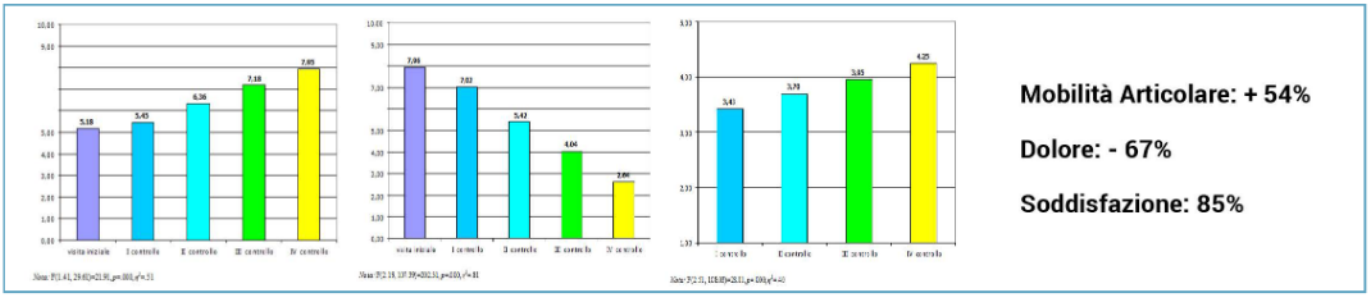
Misure di Outcome: è stata predisposta una scheda di raccolta dati che contenesse una rilevazione dei disturbi maggiormente valuta-bili con metodologia obiettiva, salvo per il dolore ove si è adottata la valutazione del paziente con un scala analogica-visiva (VAS) con punteggio da 0 a 10.

Criteri di inclusione	Criteri di esclusione
Traumi a tessuti muscolo tendinei ligamentosi	Pazienti in stato di gravidanza
Esiti chirurgici di patologie orto-pediche	Pazienti epilettici
Patologie osteoarticolari	Pazienti con neoplasie
	Pazienti con età > 80 anni

Modalità di somministrazione	
N° di sedute	Da 4 a 12
Durata trattamento	1-4 settimane
Frequenza	24/48 ore
Durata sedute	20-60 minuti

Risultati: Al momento della visita iniziale (t0), il 16.9% ha subito un trauma e il 6.6% si è sottoposto a intervento chirurgico, mentre il 55.9% presenta insorgenza di sintoma-tologia legata alla patologia. Per circa un quarto dei partecipanti (23.6%) si riscontrano patologie concomitanti, il 31.1 % è sottoposto a trattamento farmacologico. Il livel-lo di infiammazione, per la maggior parte del campione, è assente-moderato (82.4%), così come il grado di edema (97.3%); la mobilità articolare è tuttavia ridotta (M=4.89, ds=2.61) e il dolore percepito è abbastanza elevato (M=7.42, ds=l .93). Successiva-mente alla visita iniziale, i pazienti sono stati sottoposti a Limfa® Therapy e visitati a cadenze regolari per valutare l'andamento degli indici clinico-funzionali sopra descritti. Inoltre, a partire dalla 1 a visita di controllo è stato rilevato anche il grado di soddisfa-zione del paziente. Le tempistiche delle rilevazioni longitudinali sono le seguenti: **t1** à 1 a visita di controllo **a 7 giorni** dalla visita iniziale; **t2** à 2a visita di controllo a **14 giorni** dalla visita iniziale; **t3** à 3a visita di controllo a **21 giorni** dalla visita iniziale; **t4** à 4a visita di controllo a **28 giorni** dalla visita iniziale.





Limfa® Therapy, come prevedibile, è priva di effetti collaterali. In tutta la casistica esaminata non è stato segnalato alcun effetto avverso; Nella valutazione, anche analitica, è risultata evidente **una efficacia superiore alle attese**: nessun peggioramento a fronte di miglioramenti statisticamente significativi sugli outcome principali: dolore, mobilità articolare e soddisfa-zione del paziente. I risultati positivi si sono registrati senza differenze di genere e di età: ciò rafforza l'idea che, quando l'indicazione clinica è precisa, il trattamento può essere consigliato con tranquillità e sicurezza.

OSTEOARTICULAR AND MUSCULOSKELETAL PATHOLOGIES

Treatment with low intensity electromagnetic fields significantly improves joint mobility and reduces pain: study in 148 patients with osteoarticular pathologies

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Introduction: LIMFA ® Therapy is a medical device which generates information and transmits them to the cell receptors to activate and/or accelerate the endogenous processes of healing, repair and cellular regeneration. Limfa ® Therapy is an innovative treatment which acts as a ELECTRONIC MEDICATION. Most studies that have reported his efficacy, show a natural anti-inflammatory and analgesic effect, without gene- rating any secondary side effects.

Aim: determine Limfa® Therapy effectiveness in pain relief in osteoarticular and musculoskeletal pathologies, in addition to reducing inflammation and increasing joint mobility.

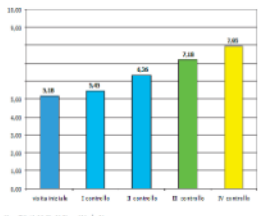
Method and Materials: A group of 148 adults, suffering from various orthopaedic disorders, undergoing Limfa® Therapy with pre-established protocols in relation to those presented. The modalities of application are standardised and preloaded so not modified by the operator.

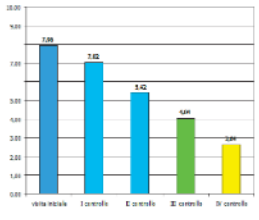
Inclusion criteria	Exclusion criteria
Muscle, tendon, ligament tissues trauma Orthopedic surgical outcomes Osteoarticular disorders	Pregnant patients Epileptic patients Patients with Neoplasms Patients > 80 years

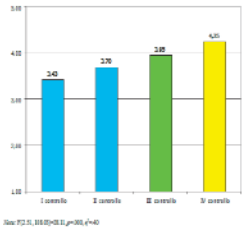
Methods	
Numbers of Therapy	From 4 to 12
Treatment duration	1-4 weeks
Frequency	24/48 hours
Duration	20-60 minutes

Outcome measures: A data sheet has been drawn up containing, besides personal and clinical details, a survey of disturbances best assessable using an objective methodology, except for pain, where the patients was assessed using an analogue-visual scale (VAS), with a score from 0 to 10.

Results: Upon initial visit (t0), 16.9% have suffered a trauma and 6.6% undergoing surgery, while 55.9% have onset of symptoms linked to the disorder. For about a quarter of the participants (23.6%) are found concomitant disorders, 31.1% are undergoing drug treatment. The level of inflammation, for most of the sample, is absent-moderate (82.4%), as well as the degree of edema (97.3%); however, joint mobility is reduced (M = 2.61, SD = 4.89) and cause pain perceived is quite high (M = 7.42, ds = 1.93). After the initial visit, patients undergoing Limfa® Therapy and visited at regular intervals to assess the progress of clinical-functional indices described above. In addition, starting from the 1st checkup was detected even the degree of patient satisfaction. The timing of longitudinal surveys are as follows: T1=1st control checkup in 7 days after initial visit; T2=2nd control visit 14 days after initial visit; T3=3rd checkup at 21 days after initial visit; T4=4th control visit 28 days after initial visit.







Joint mobility: + 54%
Pain:-67%

Satisfaction: 85%

Limfa® Therapy, as was to be expected, is without side effects. In all the examined cases no adverse effects were found; in the analytical evalua- tion, a higher than expected effectiveness became evident: no worsening and statistically significant improvements as regards the main outco- mes: pain, joint mobility and patient satisfaction. The positive results were achieved without gender and age differences: this strengthens the

Treatment with low intensity electromagnetic fields significantly improves mobility and reduces pain

Study performed on 148 patients suffering from bone and joint disorders

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Summary

A group of 148 adults, suffering from various orthopaedic disorders, underwent a therapy with low intensity magnetic fields.

The aims of the study were to assess both the clinical efficacy and the safety of the therapy with low intensity magnetic fields.

The persons undergoing such therapy obtained satisfactory results both as regards pain and functional rehabilitation, in what was a very short time for such types of disturbances (within 4 weeks).

No side or adverse effects were recorded by therapists during treatment.

Introduction

The low intensity magnetic fields system is an electromedical device which produces very low intensity magnetic-electric signals, not comparable with traditional physical therapy systems.

The magnetic fields generated by the instrument, in terms of frequency and intensity, are the same as endogenous electromagnetic forces generated by cell activity. For this reason, the creators of the instrument sustain that the magnetic-electric fields generated by the instrument interact with body cell magnetic fields (ion cyclotron-resonance, Liboff 1995) and cause changes to the intra and extra cellular permeability parameters and trigger cell processes against states of inflammation and oedema.

This work shows the results obtained after using this system to treat 148 patients suffering from bone and joint disorders or osteoarticular pathologies.

Materials and methods

The aim of this work is to evaluate the clinical efficacy of the low intensity magnetic field system in a number of specific and selected disorders of prevalently orthopaedic interest.

In this first phase, we have deliberately narrowed down the field of clinical application, to obtain a case history that can be analyzed from a statistical viewpoint.

A data sheet has been drawn up containing, besides personal and clinical details, a survey of disturbances best assessable using an objective methodology, except for pain, where the patient was assessed using an analogue-visual scale (VAS), with a score from 0 to 10.

Involved in the study were district physical therapy and rehabilitation facilities of proven experience.

The assessing professionals were taught to use the device and took part in a training phase for the correct and uniform collection of data.

Monthly board meetings were organized to discuss the collected data with the therapists and thus make sure that clinical evaluation was as consistent and uniform as possible.

The assessment schedule provided for a start time (t_0) and subsequent one week intervals (t_1, t_2, t_3, t_4).

Machine application mode times were standardized and preloaded in the program and were not therefore changeable by the operator.

Descriptive sample analysis

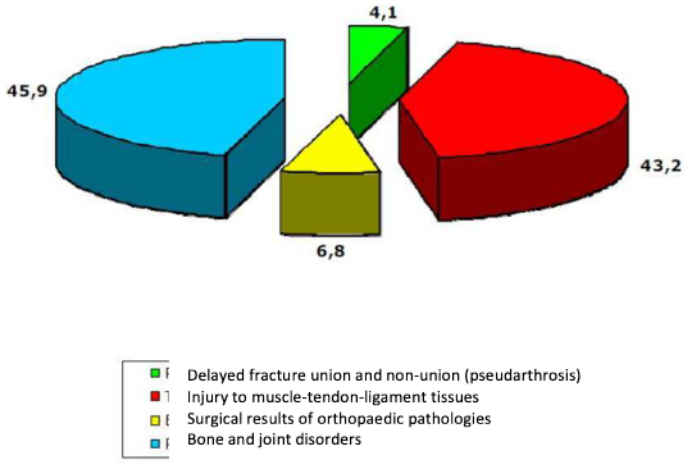
The sample consists of 148 participants, half of whom (50.7%) were involved in research in Bologna facilities. Average age was 55.8 years (sd=15.24, range 20-85 years) and was generally inclined in favour of women (men=40.2%, women=59.8%).

The disorders treated using low intensity magnetic-electric fields can be split into 4 types and more specifically:

1) Delayed fracture union and non-union
2) Injury to muscle-tendon-ligament tissues
3) Surgical results of orthopaedic pathologies
4) Bone and joint disorders

The distribution of the treated disorders is shown in fig. 1.

Figure 1 – Percentage distribution of the disorders treated with low intensity magnetic-electric fields



At the time of the initial visit (t0), the participants presented what was on average a compromised picture. 16.9% had suffered an injury and 6.6% had undergone a surgical operation, while 55.9% showed symptoms tied to the disorder.

About one quarter of the participants (23.6%) were suffering from concurrent pathologies, 31.1% were undergoing pharmacological treatment.

The level of inflammation, for most of the sample, was absent-moderate (82.4%), as was the degree of oedema (97.3%); joint mobility was however reduced (M=4.89, sd=2.61) and the pain perceived was fairly high (M=7.42, sd=1.93).

Details relating to the descriptive analyses are shown in fig. 2-3.

Figure 2 – The study population

Gender	**N**	**%**
Male	47	40.2
Female	70	59.8

Age bracket	**N**	**%**
Under 50	41	32.0
51-65 years old	47	36.7
Over 65	40	31.3

Pathology	**N**	**%**
Delayed fracture union and non-union	6	4.1
Injury to muscle-tendon-ligament tissues	64	43.2
Surgical result of orthopaedic pathologies	10	6.8
Bone and joint disorders	68	45.9

Centre	**N**	**%**
Antalgik	51	34.5
Farmacia degli Angeli	21	14.2
Fisiology Center	5	3.4
Il Glicine	33	22.3
Medical Center	14	9.5
Poliambulatorio Forni	24	16.2

City	**N**	**%**
Bologna	75	50.7
Forlì	5	3.4
Modigliana	33	22.3
Pistoia	14	9.5
Rocca San Casciano	21	14.2

Figure 3 – Clinical-functional indices of initial visit

	N	%
Injury	23	16.9
Surgical operation	9	6.6
Symptomatology	76	55.9
With concurrent disorders	35	23.6
With pharmacological treatment	42	31.1

Physio-pathological condition	**N**	**%**
Post-menopause	17	11.5
Cardiovascular diseases	3	2.0
Endocrine disorders	5	3.4
Controlled diabetes mellitus	1	0.7
Smoker	24	17.1
Drinker	12	8.6

Treated disorders	**N**	**%**
Exacerbated arthrosis disorders	8	5.4
Delayed fracture union	5	3.4
Post surgical operation situation	10	6.8
Muscle injury	18	12.2
Bone and joint disorders	54	36.5
Tendon-ligament injury	44	29.7
Others	41	20.9

Location of injury	**N**	**%**
Right arm	10	6.8
Left arm	5	3.4
Right forearm	1	0.7
Left forearm	3	2.0
Right hand	5	3.4
Left hand	5	3.4
Right thigh	5	3.4
Left thigh	6	4.1
Right leg	8	5.4
Left leg	3	2.0
Right foot	1	0.7
Left foot	2	1.4

Inflammation (calor)	N	%
Absent	66	44.6
Slight	19	12.8
Moderate	37	25.0
Serious	26	17.6

Oedema	N	%
Absent	91	61.9
Slight	32	21.8
Moderate	20	13.6
Serious	4	2.7

Hematoma	N	%
Absent	137	95.8
Present	6	4.2

	M	ds
Joint mobility (0-10)	4.89	2.61
Pain perceived (0-10)	7.42	1.93

Longitudinal analysis on general sample

After the initial visit, patients underwent treatment by means of very low intensity magnetic-electric fields and were regularly visited to determine the above clinical-functional indices. Furthermore, starting with the first checkup, the degree of patient satisfaction was also assessed.

Longitudinal analysis schedules were as follows:

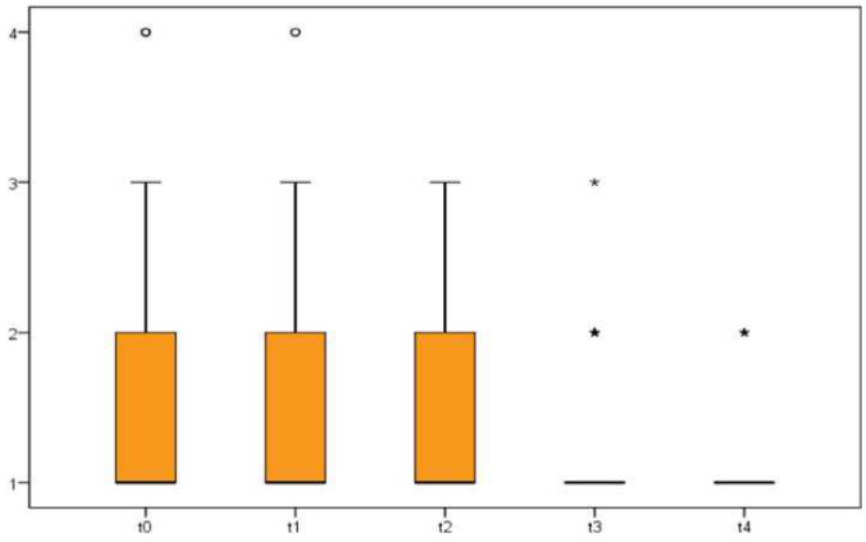
- $\mathbf{t_1}$ → 1 checkup at **7 days** from initial visit
- $\mathbf{t_2}$ → 2nd checkup at **14 days** from initial visit
- $\mathbf{t_3}$ → 3rd checkup at **21 days** from initial visit
- $\mathbf{t_4}$ → 4th checkup at **28 days** from initial visit

The data relating to the level of inflammation and oedema, having been assessed by con-continuous ordinal scales and presenting a non-normal distribution, were treated by means of non-parametric statistical analyses (Friedman test for general longitudinal analysis, Wilcoxon test for *post-hoc* among the different assessments).

The results showed a significant drop in the level of inflammation, and the subsequent *post-hoc* tests indicate that improvement was significantly gradual at each assessment up to 21 days from the initial visit, while no improvements were found between the last two checkups (fig. 4).

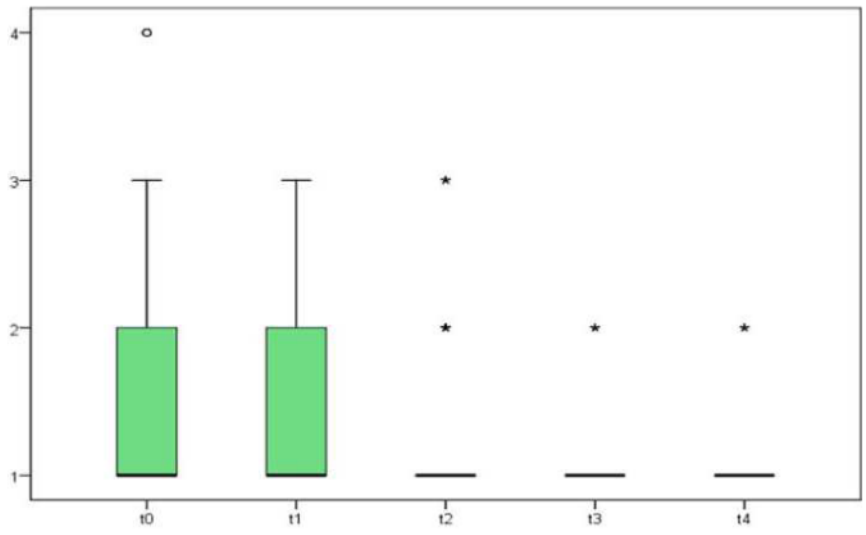
As regards the level of oedema, in this case as well the analyses showed a significant and gradual drop to t_3 and the absence of significant improvements between the last two checkups (fig. 5). It must nevertheless be underlined that, as pointed out in the section relating to descriptive analyses, the great majority of the sample started with a slight level of inflammation and oedema, and it was therefore only natural for the margin of improvement to be small.

Figure 4 – Longitudinal analysis of inflammation level



Note: X^2 (4)=66.45, *p*=.000

Figure 5 – Longitudinal analysis of oedema



Note: X^2 (4)= 63.24, *p*=.000

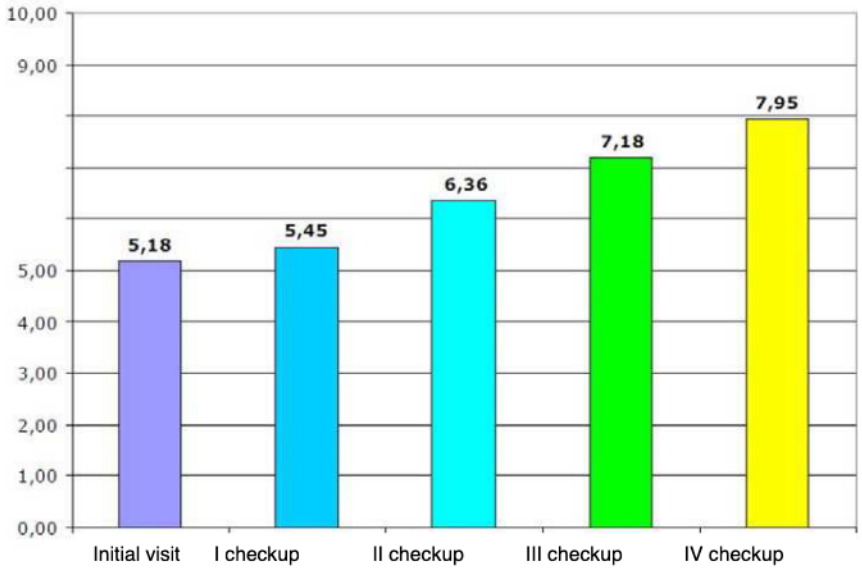
The data were subsequently analysed regarding the joint mobility of the patients, the pain perceived by them and the degree of satisfaction expressed in assessments t_1- t_4. In this case a repeated measurement variance analysis was used.

With respect to joint analysis, the results indicate that this goes from insufficient to good

throughout the treatment period; more specifically, no improvements were found between the initial visit and the 1st checkup, but this was followed by a significant and gradual improvement in all subsequent assessments (fig. 6).

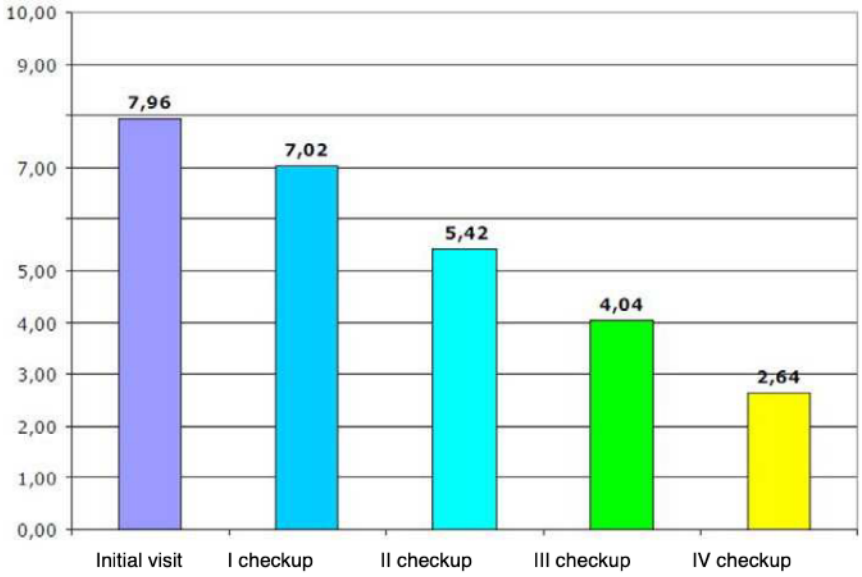
The results relating to the level of pain perceived by the patients in the different visits show a significant drop starting from the 1st visit; pain went from extreme to greatly reduced throughout the treatment period (fig. 7). Assessments concerning the degree of patient satisfaction were also positive: satisfaction tended to increase at each subsequent checkup (fig. 8).

Figure 6 – Longitudinal analysis of joint mobility



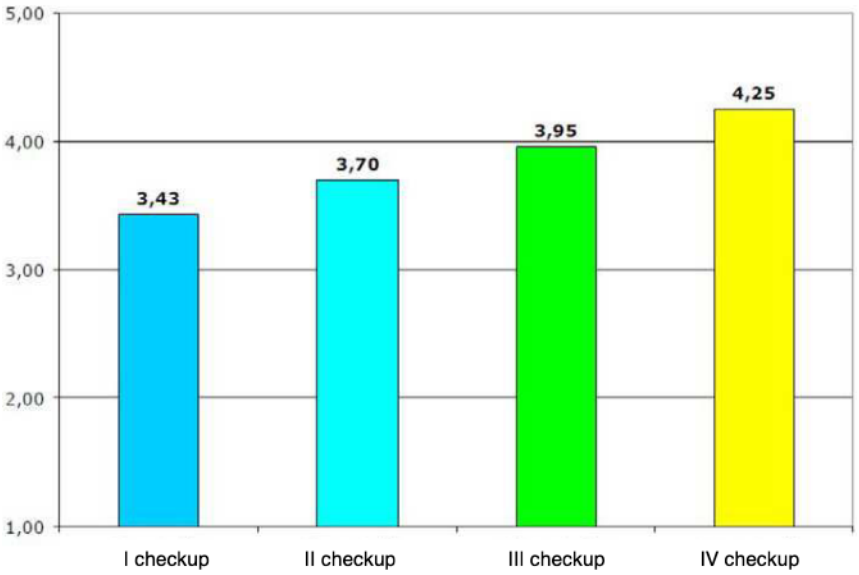
Note: $F(1.41, 29.61)=21.91$, $p=.000$, $\eta^2=.51$

Figure 7 – Longitudinal analysis of level of perceived pain



Note: F(2.19, 107.39)=202.31, p=.000, η^2=.81

Figure 8 – Longitudinal analysis of degree of satisfaction



Note: F(2.51, 108.03)=28.11, p=.000, η^2=.40

Longitudinal analysis according to type of disorder

The data collected regarding joint mobility, perceived pain and degree of satisfaction subsequently underwent two-way repeated measurement variance analysis to investigate any moderation effects by variables such as the type of disorder, the gender and the age bracket of the participants.

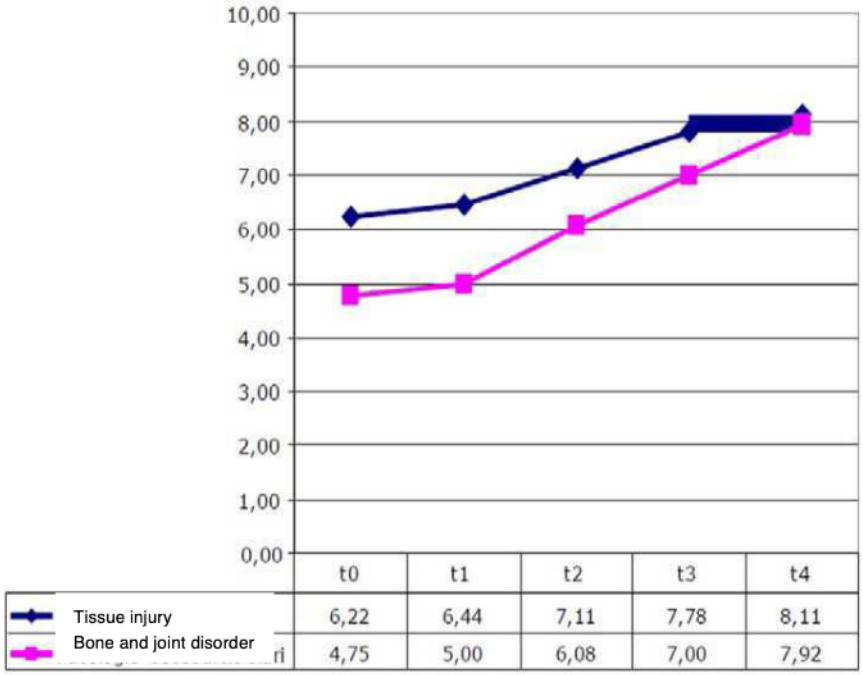
As regards the type of disorder, it was not possible to analyse all the disorders suffered by the sample, because the percentage of patients with delayed fracture union and surgical results of orthopaedic disorders was very small at the current stage of experiments. The decision was therefore taken to analyse the differences between patients with injuries affecting muscle-tendon-ligament tissues and with bone and joint disorders.

From the analyses performed, it appears that, as regards joint mobility, an improvement effect repeated itself over time for both disorders, but no interaction effect was found (fig. 9); it can therefore be said that the type of disorder does not apparently affect the success of the treatment in terms of patient mobility.

In the same way, the improvement of pain level also evolved significantly for both disorders without showing any type of interaction, and so it seems that the effect on pain does not depend on the type of disorder (fig. 10).

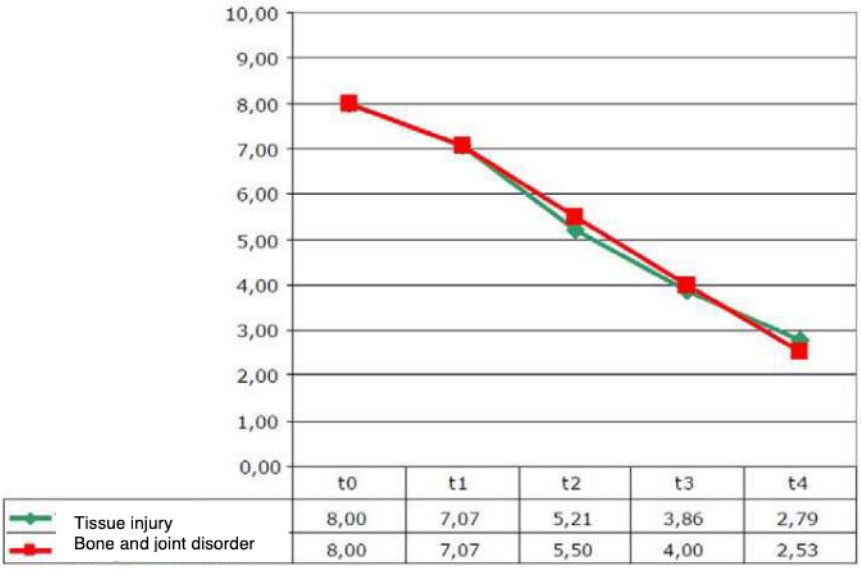
The same result would also seem to appear as regards the satisfaction expressed by the patients: this increased as time passed and with each checkup, but was not moderated by the disorder for which the participants were being treated (fig. 11).

Figure 9 – Longitudinal analysis on level of joint mobility in accordance with the type of disorder



Note: F(4, 16)=.53, *n.s.*

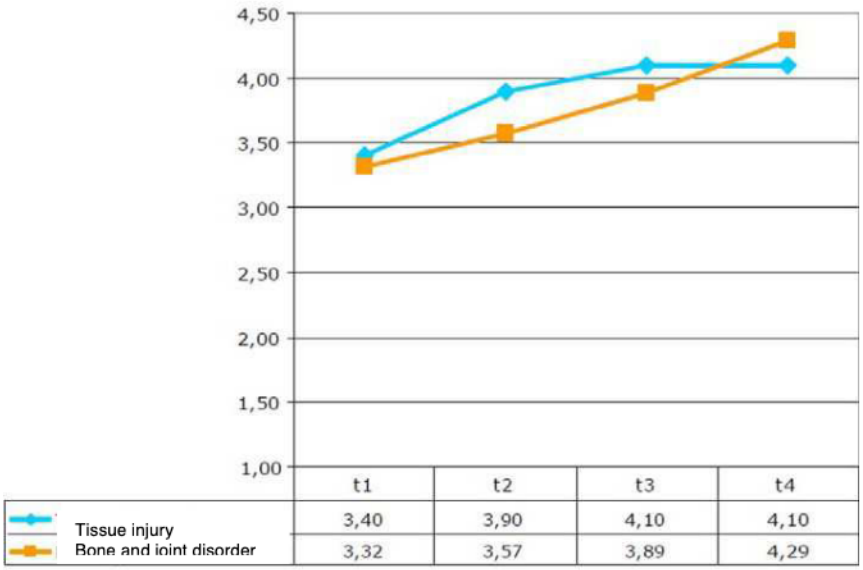
Figure 10 – Longitudinal analysis on level of pain perceived according to type of disorder



	t0	t1	t2	t3	t4
Tissue injury	8,00	7,07	5,21	3,86	2,79
Bone and joint disorder	8,00	7,07	5,50	4,00	2,53

Note: F(4, 39)=.53, *n.s.*

Figure 11 – Longitudinal analysis on degree of satisfaction according to type of disorder



	t1	t2	t3	t4
Tissue injury	3,40	3,90	4,10	4,10
Bone and joint disorder	3,32	3,57	3,89	4,29

Note: F(3, 34)=1.97, *n.s.*

Longitudinal analysis according to gender

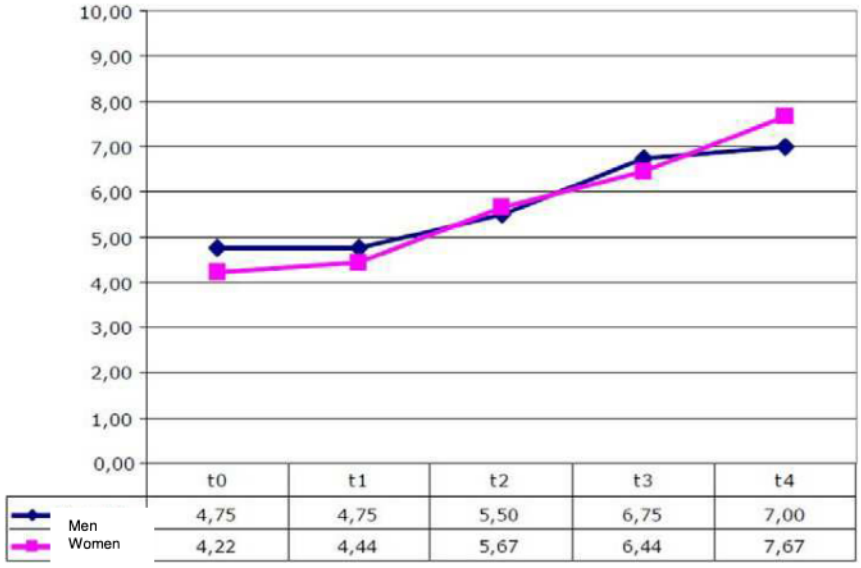
Secondly, any presence was investigated relating to a moderating effect on the three previous indices due to the gender of the participants.

As regards joint mobility, no differences were found between men and women nor interaction effects between geneder and treatment efficacy (fig. 12).

In the same way, the perceived pain did not appear moderated by the gender of the participants: a significant drop in pain appeared over time, but there were no big differences between men and women as regards this evolution (fig.13).

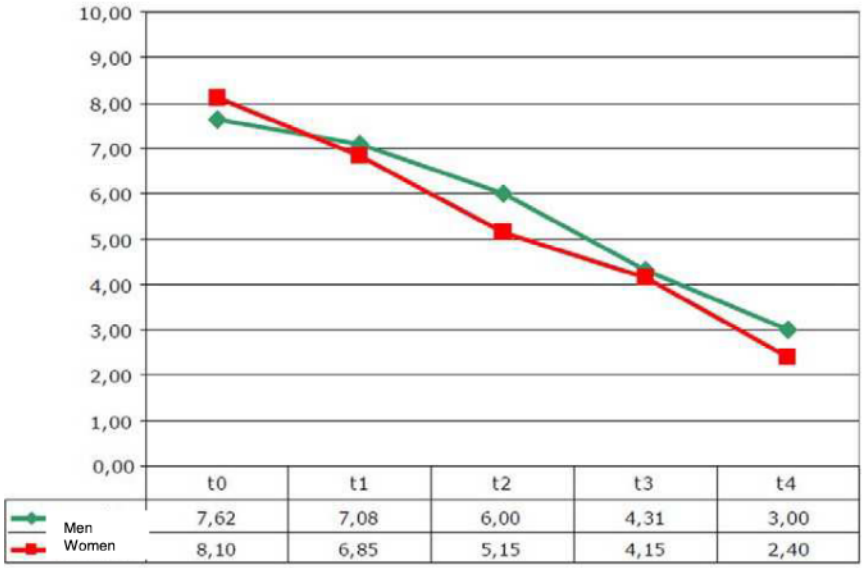
Finally, the same trend occured for the degree of satisfaction, which tended to increase significantly from one visit to another but without any difference appearing between men and women or interactions between patient gender and satisfaction expressed for the treatment (fig. 14).

Figure 12 – Longitudinal analysis as regards level of joint mobility according to gender



Note: F(4, 13)=.69, *n.s.*

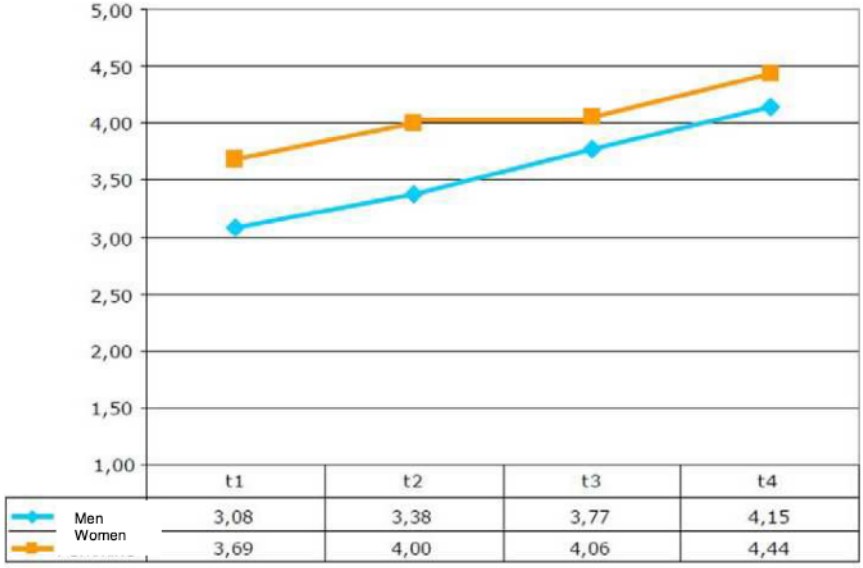
Figure 13 – Longitudinal analysis as regards level of pain perceived according to gender



	t0	t1	t2	t3	t4
Men	7,62	7,08	6,00	4,31	3,00
Women	8,10	6,85	5,15	4,15	2,40

Note: F(4, 28)=3.94, *n.s.*

Figure 14 – Longitudinal analysis as regards degree of satisfaction according to gender



	t1	t2	t3	t4
Men	3,08	3,38	3,77	4,15
Women	3,69	4,00	4,06	4,44

Note: F(3, 25)=1.36, *n.s.*

Longitudinal analysis according to age

To interpret the interactions between effectiveness of treatment and age of participants, it was decided to split the patients up into three equally distributed age brackets:

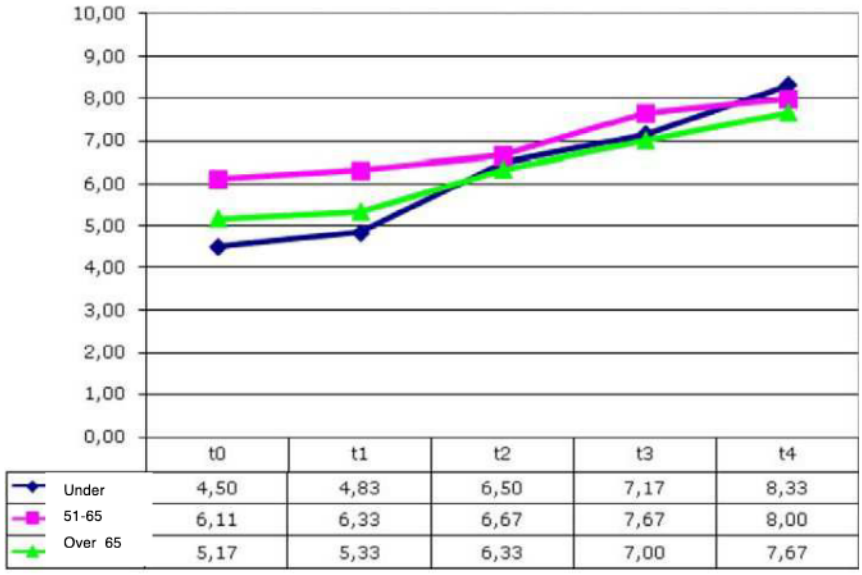
- Under 50
- 51 - 65
- Over 65

The results relating to joint mobility showed no type of moderation due to age: all three groups of participants significantly improved from t_0 to t_4, but no differences could be seen between age groups during this improvement (fig. 15).

As regards the level of patient pain, no interaction effect was seen. As previously said, the perceived pain tended to drop as time passed (and with treatments), but in a linear way and not according to patient age (fig. 16).

Finally, the analyses performed on the degree of satisfaction of the participants, according to age, produced the same results as above: satisfaction increased significantly from the first to the last checkup, without however any statistically significant differences between the three ages brackets considered (fig. 17).

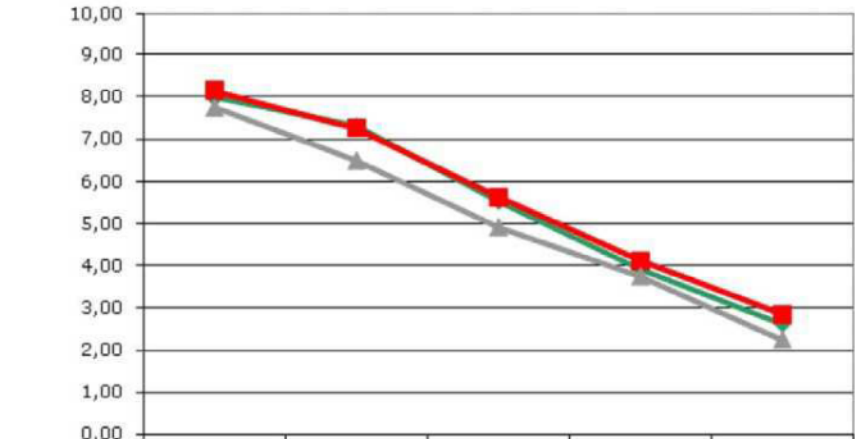
Figure 15 – Longitudinal analysis of level of joint mobility according to age bracket



	t0	t1	t2	t3	t4
Under	4,50	4,83	6,50	7,17	8,33
51-65	6,11	6,33	6,67	7,67	8,00
Over 65	5,17	5,33	6,33	7,00	7,67

Note: $F(8, 32)=.69, n.s.$

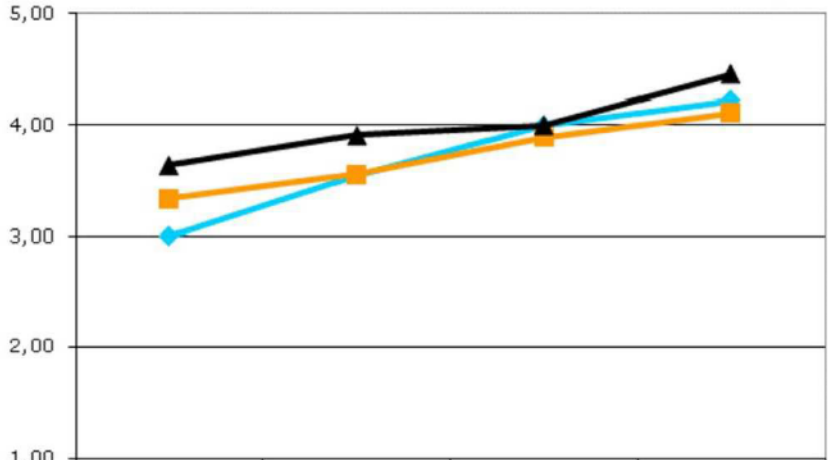
Figure 16 – Longitudinal analyses as regards level of perceived pain according to age bracket



	t0	t1	t2	t3	t4
fino a 50	8,00	7,31	5,54	3,92	2,62
51-65	8,16	7,26	5,63	4,11	2,84
più di 65	7,75	6,50	4,92	3,75	2,25

Note: $F(8, 78)=.74$, *n.s.*

Figure 17 – Longitudinal analyses as regards degree of satisfaction according to age bracket



	t1	t2	t3	t4
Under 50	3,00	3,56	4,00	4,22
51-65	3,33	3,56	3,89	4,11
Over 65	3,64	3,91	4,00	4,45

Note: $F(6, 68)=1.24$, *n.s.*

Statistical considerations

The collected data appear positive, although a possible distorsion must be taken into consideration in the longitudinal analyses due to a number of missing data: it has not always been possible to obtain data relating to all the surveys made, an element that translates into a reduction of the sample when treated with repeated measurement analyses. At the same time, the non-normality of the distribution of the indices relating to the presence of inflammations and/or oedema does not permit processing the data with parametric statistics and, consequently, analyzing in any depth the moderation effects investigated in the previous paragraphs.

Nevertheless, if we focus on the results obtained, experimentation would seem to produce a series of significant changes. Firstly, the analyses performed on the general sample show a reduction of oedema and inflammation in patients, and above all a clear and substantial improvement at joint mobility and perceived pain level. If, with respect to the presence of inflammation and/or oedema, the change is relatively small (also considering the already non-compromised initial picture in patients at the time of the first visit), the same cannot be said for the other indices: the degree of joint mobility goes from insufficient to good and the pain, initially perceived as very high, is strongly reduced within a period of 4 weeks until it is very small indeed. At the same time, as can be expected, the degree of satisfaction of the patients increased significantly between the 1st and the 4th checkup.

The results described thus far are also reconfirmed in the subsequent analyses, aimed at checking the presence of any moderation effects on the experimental treatment due to the type of disorder treated or to demographic variables (gender and age). The positive trends as regards mobility, pain and satisfaction also appear in each sub-group, but no interaction effect has been found with the above-mentioned variables. Nevertheless, this is not a negative or worrying result: the absence of interactions between the improvements found and the clinical or demographic variables enables us to imagine that the efficacy of the experimental treatment is transversal and separate from other elements.

Clinical considerations

The size of the sample (148 cases studied) appears enough to express valid considerations at statistical level. The treated cases all refer to disorders of orthopaedic interest. It must nevertheless be realized that, within these, there is a certain disproportion between bone and joint disorders (45.9%) and injuries(43.2%) and the other two (surgical results of orthopaedic disorders and bone and joint disorders) which, together, fail to reach 12%. Nevertheless, the consistency of the collected data minimizes this disproportion even though it suggests the need to extend research in terms of numbers.

The group nevertheless appears balanced in terms of gender even though, as was to be expected, women prevail in accordance with the epidemiology of the treated disorders.

The average age is 55.8, but with a large interval that goes to show the method can be applied to practically any age.

Fig. 3 shows the clinical-functional situation at the time of enrolment.

While on the one hand there are signs of reduced inflammation and oedema, on the other there is a considerable impairment of joint mobility (5.18/10) and very high perceived pain (7.96/10).

These data are very important because, when the time factor is assessed (figures 3- 4 - 5 and 6), a clear improvement can be seen of the most compromised parameters (pain and joint mobility) and a modest reduction of oedema and signs of phlogosis, scarcely present at t_0. This is an indirector/ pointer to the consistency of the collected data.

In particular, as regards joint mobility, it must be emphasized that the improvement achieved during treatment is of particular interest both because of the extent of the improvement itself and because this is a particulary precise and objective indicator (mobility was measured according to degree of joint ROM).

As regards perceived pain, the pattern was particularly satisfactory. The global figure shows 7.96 as initial value, which drops drastically to 2.64 at the end of treatment. This is a huge reduction for an aspect which represents the main outcome in this type of treatment.

Fig. 8, which represents the pattern of the **degree of patient satisfaction**, confirms that of pain inasmuch as it increases as pain decreases.

For the reasons mentioned before, the comparative analysis of the treated disorders has been restricted to the two most representative in terms of numbers. A comparison was therefore made between tissue injuries and bone and joint disorders. The figures 9, 10 and 11 show that there are no statistically significant differences as regards data relating to joint mobility, perceived pain and degree of satisfaction. Efficacy therefore appears equally represented in the disorders taken into consideration. The figures 12, 13 and 14 show the longitudinal analysis of the same parameters according to **gender**. In no case do significant differences appear between men and women even though fig. 14, relating to the degree of satisfaction, shows a slightly better inclination in this sense on the part of women.

The figures 15, 16 and 17 show the longitudinal analysis relating to the parameters considered in relation to the **patient's age**. The brackets into which the patients have been split are youthful-adult (under 50), adult (51 - 65) and elderly (over 65).

In this case as well, the figures do not show significant differences between the various age brackets considered. It must however be underlined that the youthful bracket shows a slightly more positive pattern compared to the other age brackets. This result is particularly interesting because it bucks the trend with respect to personal satisfaction analyses which always see youngsters a little "less pleased" than their older counterparts.

Conclusions

From an analysis of the above data, the following considerations can be made:

1. Therapy with low intensity magnetic fields, as was to be expected, is without side effects. In all the examined cases, no adverse effects were found.
2. Assessments, including analytic, showed better than expected results: no worsening and statistically significant improvements as regards the main outcomes: pain, joint mobility and patient satisfaction.
3. The positive results were achieved without any differences regarding gender and age: this strengthens the idea that, when clinical indications are precise, treatment can be safely recommended.
4. An extension of case studies could lead to sounder statistical data as regards indications other than those already assessed (post-injury disorders, sports injuries, etc.).

Bibliography

1. Strasák L, Vetterl V, Smarda J.: **Effects of low-frequency magnetic fields on bacteria Escherichia coli.** Bioelectrochemistry. 2002 Jan;55(1-2):161-4
2. Selvam R, Ganesan K, Narayana Raju KV, Gangadharan AC, Manohar BM, Puvanakrishnan R.: **Low frequency and low intensity pulsed electromagnetic field exerts its antiinflammatory effect through restoration of plasma membrane calcium ATPase activity.** Life Sci. 2007 Jun 6;80(26):2403-10. Epub 2007 May 1
3. Bao X, Shi Y, Huo X, Song T.: **A possible involvement of beta-endorphin, substance P, and serotonin in rat analgesia induced by extremely low frequency magnetic field.** Bioelectromagnetics. 2006 Sep;27(6):467-72
4. Zhadin MN, Fesenko EE.: Ionic cyclotron resonance in biomolecules. Biomed Sci. 1990 Mar;1(3):245-50.
5. McLeod BR, Liboff AR, Smith SD.: Electromagnetic gating in ion channels. J Theor Biol. 1992 Sep 7;158(1):15-31
6. Fojt L, Strasák L, Vetterl V, Smarda J.: **Comparison of the low-frequency magnetic field effects on bacteria**
   Escherichia coli, Leclercia adecarboxylata and Staphylococcus aureus. Bioelectrochemistry. 2004 Jun;63(1-2):337-41
7. Liboff AR.: **Electric-field ion cyclotron resonance.** Bioelectromagnetics. 1997;18(1):85-7
8. Manikonda PK, Rajendra P, Devendranath D, Gunasekaran B, Channakeshava, Aradhya RS, Sashidhar RB, Sub- ramanyam C.: **Influence of extremely low frequency magnetic fields on Ca2+ signaling and NMDA receptor functions in rat hippocampus.** Neurosci Lett. 2007 Feb 14;413(2):145-9. Epub 2006 Dec 28
9. Nossol B, Buse G, Silny J.: **Influence of weak static and 50 Hz magnetic fields on the redox activity of cy- tochrome-C oxidase.** Bioelectromagnetics. 1993;14(4):361-72.

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