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LONG-TERM FOLLOW-UP OF CONSERVATIVELY TREATED CHRONIC TENNIS ELBOW PATIENTS. A PROSPECTIVE AND RETROSPECTIVE ANALYSIS

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ABSTRACT. This study aimed to assess the long-term outcome of progressive exercise and local pulsed ultrasound in the treatment of 30 chronic tennis elbow patients (2 men, 18 women, mean age 42.3 years). The patients were originally randomised into 1) four-step progressive exercise (EX, n = 16) and 2) local pulsed ultrasound (US, n = 14) treatment groups. Before the beginning of the treatment, the groups were similar in terms of pain scores, sick-leave days and duration of symptoms. The patients underwent an 8-week treatment intervention. Long-term follow-up evaluation of the patients was performed 1) prospectively using a pain questionnaire on VAS and pain drawings classified into 5 categories, and 2) retrospectively with a postal questionnaire (which was sent to the patients to fill in. Sick-leave days, medical and physiotherapy visits, operations, early retirements and job relocations were inquired in the postal questionnaire. The diagnosis-related sick-leave days of the patients were collected from the Database of the Social Insurance Institution of Finland and the number of operations from the local hospital register.

Twenty-three patients (12 in the EX group and 11 in the US group) responded. The mean follow-up time was 36 months. After the treatment the patients in the EX group needed significantly less physiotherapy (p = 0.02), fewer medical consultations (p = 0.005) and other treatments and had fewer sick-leave days (p = 0.005) than before the treatment intervention. The patients in the US group had after the treatment intervention more 17 medical visits (ns), 291 sick-leave days (ns) and less 95 physiotherapy visits (ns) than before the treatment. Eight patients (67%) in the EX group and 5 (45%) in the US group still held their previous job, while two patients in the US group, but none in the EX group were absent from work because of the tennis elbow syndrome. The patients in the EX group reported significantly lower pain scores on VAS than those in the US group. The mean pain drawing category was 1.5 in the EX group and 2.7 in the US group (p = 0.008). All the pain scores and pain drawing categories in the EX group had changed to be significantly better than in the US group, where only pain under strain had significantly improved. Because of resistant symptoms, 5 patients were operated in the US group and one in the EX group. Neither spontaneous healing, nor self-limiting of the disorder were noted during the follow-up period. The progressive exercise evaluated in this study showed beneficial long-term effects compared to ultrasound treatment in terms of pain alleviation and working ability, and the functional overall condition of the exercise patients was also better. Exercise may be able to prevent chronicity and should hence be tried and recommended.

Key words: tennis elbow, physical exercise, ultrasound, follow-up, outcome.

INTRODUCTION

The tennis elbow syndrome or lateral epicondylitis is a troublesome disorder of the arm causing prolonged disability and sick-leaves and in certain jobs even early retirement. Precise diagnosis is therefore important and all possible actions are needed to prevent prolonged disability.

Most patients are treated conservatively (14), even when the disorder is chronic. About 3% of patients have usually been operated because of chronic symptoms (5). The long-term effects of different conservative or operative methods have been poorly studied before. Different operative methods have been compared. However there is a lack of scientific evidence concerning the treatment of lateral epicondylitis, even in chronic cases (6).

In our previous randomised study (11), 39 patients were treated conservatively either with progressive strengthening and stretching exercises or with local

pulsed ultrasound to compare the effects of active treatment and the traditionally used local passive treatment. The results showed that exercise was superior to pulsed ultrasound, having good effects on pain at rest and under strain, a good effect on working ability and sick-leaves, and a beneficial effect on the muscle performance of the arm and on clinical manual diagnostic tests in a short-term eight-week follow-up.

In the first report, the results were based on primary evaluation immediately after the original treatment intervention. Long-term randomised longitudinal studies on the conservative treatment of tennis elbow are also lacking. In back rehabilitation, active programs have been found to produce good results (10), and it would therefore be interesting to know the long-term effects of these two treatment techniques after the original treatment intervention.

SUBJECTS AND METHODS

This study covered 30 randomised chronic tennis elbow patients who had, 2–4 years earlier, been treated with either a four-step progressive strengthening and stretching arm exercise program (n = 16) or with local pulsed ultrasound therapy (n = 14), with a pulse 1:5, 0.5 W/cm^2, up to 15 treatment visits (11).

As an inclusion criterion to the study group, a patient had to have clear clinical lateral epicondylitis with no other arm disease or general pain disorder. All the patients had to have positive Mill's test (1) as well as resisted wrist or middle finger extension, which had to produce typical pain in the insertion area of the involved lateral epicondyle. A third inclusion criterion was local tenderness in palpation on the lateral epicondyle.

Table I. *Patient data. Range is given in parenthesis*

	Exercise group	Ultrasound group
Total n = 30	16	14
Returned n = 23	12	11
Men/women	4/8	4/7
Mean age (years)	45 (36–54)	44 (38–57)
Mean height (cm)	167 (154–184)	166 (152–179)
Mean weight (kg)	74 (55–108)	75 (45–88)
Side of disorder		
dominant	9	9
non-dominant	3	2

The patients having no clinical lateral epicondylitis were excluded from the study. Principal exclusion criteria were diagnosed cubital osteoarthritis, carpal tunnel syndrome, diagnosed rheumatoid arthritis, severe cervical spondylosis, painful shoulder or rotator cuff tendinitis and previous humeral, cubital, forearm or wrist fracture causing limitations in the arm function. The randomisation was done by drawing a lot.

The patient data and characteristics are presented in Table I. The groups did not differ significantly before the original treatment intervention in terms of the duration of symptoms, pain scores on a visual analogue scale (VAS), professional status or the number of treatment episodes.

The study design included both prospective and retrospective methods. The retrospective examination method was a postal questionnaire sent to the patients to fill in. Therapy interventions, use of medication, operations, job changes, sick-leaves

Table II. *Study design*

1. Prospective methods					
	PQ*	PQ*	PQ		
	PD*	PD*	PD		
	Clin. eval. *	Clin. eval. *			
	Muscle f. *	Muscle f. *			
Time – 12	0 Treatment	+2	+12	+36 months	
2. Retrospective methods					
					Postal Questionnaire
- - - - - - -		- - - - - - - - - - - - -			-treatments, visits
		- -			-operations
		- -			-job situation
		- -			-retirements
Time – 12	0 Treatment	+2	+12	+36 months	
		- -			Hospital register
					-operations
		- -			SII data
					-sick-leaves
					-retirements

The methods indicated with an asterisk (*) were used in the previous study. The dashed lines represent the retrospective period on time scale studied. PQ = pain questionnaire, PD = pain drawing.

days, early retirements or prevalent symptoms were inquired about. Especially, the patients were asked to comment on the need for treatments during a period of one year before and after the original treatment intervention. The study design and procedure is shown in Table II, where the prospective and retrospective methods and periods studied are presented on a time scale from one year before to three years after the original treatment intervention. A pain questionnaire—equal to the questionnaire presented before and after the original treatment—with questions on pain at rest, pain under strain, subjective working disability, limitations in hobby activities, ability to lift objects, sleeping disturbances and a whole-body pain drawing was filled in by the patients. The patients were asked to produce a current pain score assessment and a pain drawing. The pain drawing was categorized into 6 groups according to the location of pain as follows: 1. local pain on the elbow region, 2. local and distal pain in the hand and the forearm, 3. whole arm pain, 4. arm and neck pain and 5. generalized pain. The pain evaluation was prospective and the data had been collected in exactly the same way previously (11) before and after the original treatment. Data on the operations of the patients who did not return the postal questionnaire (n = 7) were collected from the hospital register.

Because the follow-up time was several years long and the patients could therefore have difficulties in remembering the treatments and sick-leave days during the past years, the national database of the Social Insurance Institution was used to determine the diagnosis-related sick-leave days in over period of one year before and after the original treatment intervention of the patients of this study. Retirements were registered from the database and also from the postal questionnaire.

The patients' outcome and need for treatments during a period of one year before and after the original treatment were analyzed from the replies to the questionnaire. Sick-leave days and early retirements were analyzed from the database of the Social Insurance Institution. The present pain questionnaire scores and pain drawings were analyzed and the results were compared with the results obtained before and after the original treatment within each group. The results were also compared between the two treatment groups by using Student's t-test and Wilcoxon's nonparametric test for matched pairs.

RESULTS

Twenty-three of the 30 patients (8 men, 15 women) or 76.6% filled in and returned the questionnaire. The average follow-up time was 36 months. The patients' job situation, use of treatments and number of operations in both treatment groups during the follow-up period is presented in Table III. A more detailed analysis of the medical and physiotherapy visits is presented in Table IV.

One patient in the exercise group and 5 patients in the ultrasound group were operated during the follow-up period. The patients in the ultrasound group had been given more physiotherapy (3.9 visits per patient vs 1.0 visits per patient) during the year following the original treatment and they had made more medical visits to a doctor (5.4 vs 1.3 visits per patient) than the patients in the exercise group. The differences are not statistically significant between the groups because of the great variability in the number of visits. The patients in the US

Table III. *Number and percentage of patients given different therapies during the follow-up period and the current job situation in both treatment groups*

	Exercise group n = 12		Ultrasound group n = 11	
	No.	%	No.	%
Treatments				
Physiotherapy	1	8	4	36
Injections	1	8	3	27
Acupuncture	0	0	1	9
Oral medication	3	25	5	45
Percutaneous medication	5	42	5	45
Home exercise	3	25	1	9
Operation	1	6*	5	36*
Present job situation				
Previous job	8	67	5	45
Absent from work	4	33	6	55
Unemployed	2	17	1	9
Sick-leave	0	0	2	18
Retired	0	0	2**	18**
Other cause	2	17	1	9
Absent from work because of tennis elbow	0	0	2	18

* = The values cover the total study population, n = 16 in the exercise group and n = 14 in the ultrasound group (Hospital register).

** = Cause other than the tennis elbow syndrome.

Table IV. *Medical and physiotherapy visits and sick-leave days in both treatment groups during a period of one year before and after the original treatment intervention. The columns include the total number of visits or days (Tot) and the visits or days per patient (PP).*

	Exercise group		Ultrasound group		Difference		
	Tot	PP	Tot.	PP	Tot.	PP	P-value
Medical visits							
before treatment	50	4.2	42	3.8	+8	+0.4	NS
after treatment	15	1.3	59	5.4	−44	−4.1	NS
Difference	−35	−2.9	+17	+1.6			
P-value*	0.005		0.35 = NS				
Physiotherapy visits							
before treatment	105	8.8	138	12.5	−33	−3.7	NS
after treatment	12	1.0	43	3.9	−31	−2.9	NS
Difference	−93	−7.8	−95	−8.6			
P-value*	0.02		0.12 = NS				
Sick-leave days							
before treatment	424	35	342	31	+82	+4	NS
after treatment	47	4	633	58	−586	−54	p = 0.001
Difference	−377	−31	+291	+27	668	58	
P-value*	0.005		0.98 = NS				

* = Wilcoxon's test for matched pairs.
** = Student's unpaired t-test.

group had had significantly more sick-leave days (633 vs 47, p = 0.001) than the patients in the EX group.

Eight patients (67%) in the exercise group and 5 patients (45%) in the ultrasound group still held their previous job (Table III). Two patients in the ultrasound group were retired because of another disease and 2 were on sick-leave because of epicondylitis. Two patients in the ultrasound group and none in the exercise group were absent from work because of the tennis elbow syndrome. The share of unemployment was almost the same in each group. The pain questionnaire, the pain drawing results and the comparison between the groups at follow-up are presented in Table V.

The changes in the pain questionnaire and the pain drawing from the beginning of the original treatment intervention to the follow-up are presented in Table VI, where the results show significant changes in all pain scores and in the pain drawing within the exercise group. In the ultrasound group, only pain under strain showed significant changes. The pain questionnaire and pain

Table V. *Pain questionnaire results (cm VAS) and pain drawing ranking in both treatment groups and a comparison between the groups. The values are means (SD). The statistical comparison between the groups was made using Student's unpaired (two sample) t-test, and the 95% confidence limits of the difference are presented*

	Exercise		Ultrasound		Difference		
	VAS	SD	VAS	SD	Mean	P-value	95% C.I. of diff.
Pain at rest	1.0	1.2	3.3	3.6	−2.3	0.05	−4.5, −0.01
Pain under strain	2.8	2.6	5.9	3.4	−3.1	0.02	−5.6, −0.5
Working disability	2.2	2.3	4.9	3.1	−2.7	0.02	−5.1, −0.4
Lifting ability	0.9	2.2	5.0	4.1	−4.1	0.007	−6.9, −1.2
Hobby limitation	1.7	2.6	4.4	3.5	−2.7	0.04	−5.4, −0.1
Sleep disturbance	0.8	1.1	3.8	3.6	−3.0	0.01	−5.3, −0.8
	Pain drawing classification (CL)						
	CL	SD	CL	SD			
Pain drawing (0–5)	1.5	1.1	2.7	0.9	−0.4	0.0001	−2.1, −0.4

drawing results before and after the initial treatment and at follow-up are also presented graphically in Figures 1A-E, and a comparison is made between the groups at follow-up.

The results show that the patients in the exercise group had significantly less pain and the pain in their drawings was not so widespread as in the ultrasound group. It is significant that the pain of the patients analyzed 36 months later remained at almost the same level as at the end of the original treatment intervention in both groups. No statistically significant changes within either group in the pain scores or in the pain drawing after the original treatment were noted.

DISCUSSION

The results show that the patients in the exercise group had a better outcome and prognosis in the 36-month follow-up. They had significantly less pain and they had retained the good effect of the primary exercise intervention and had made fewer doctor and physiotherapy visits and had fewer sick-leave days than before the original treatment intervention. The patients in the group treated with ultrasound had had significantly more operations and made more visits to doctors and physiotherapists than the patients in the exercise group.

This was the first time when the long-term effects of conservative treatments, especially exercise on the chronic tennis elbow syndrome were evaluated. There are no controlled studies available on the effects of exercise in treating chronic tennis elbow, although many authors (2, 7, 8) have recommended exercises, but there are numerous contradictory results on the effects of ultrasound treatment (1, 3, 9, 12). There is also a lack of scientifically controlled studies on the treatment of lateral epicondylitis (6), which is why evaluation of the long-term effects of conservative treatment is important.

A patient's overall outcome can be evaluated with pain questionnaires and a working disability evaluation. The need for help from health professionals, especially doctors and physiotherapists, the need for other therapies and the use of medical and health services because of symptoms pinpoint the problems in the outcome of the disorder.

The method of evaluating the clinical condition with a retrospective postal questionnaire involves a lot of difficulties, because the patients' memory may have influenced the results. The pain questionnaires and drawings were, however, based on a real-time evaluation

Table VI. *Pain questionnaire results (cm VAS) and Pain drawing ranking (0–5) in both treatment groups before the original treatment intervention (initial) and at follow-up, the changes within each group and a comparison within the groups. The values are means. The statistical comparison within the groups was made using Wilcoxon's test for matched pairs*

	Initial Cm VAS	Follow-up Cm VAS	Mean Cm VAS	Z-value	P-value
Exercise group					
Pain at rest	3.7	1.0	−2.7	−2.75	0.006
Pain under strain	7.0	2.8	−4.2	−2.76	0.006
Working disability	6.6	2.2	−4.4	−3.06	0.002
Lifting ability	3.5	0.9	−2.6	−2.13	0.03
Hobby limitation	5.0	1.7	−3.3	−2.67	0.008
Sleep disturbance	2.8	0.8	−2.0	−2.35	0.002
Ultrasound group					
Pain at rest	3.4	3.2	−0.7	−0.36	0.72 = NS
Pain under strain	8.1	5.8	−2.2	−2.22	0.03
Working disability	6.5	4.9	−1.6	−1.69	0.09 = NS
Lifting ability	4.2	5.0	+0.8	0.36	0.72 = NS
Hobby limitation	5.7	4.4	−1.3	−1.02	0.31 = NS
Sleep disturbance	4.5	3.8	−0.7	−0.61	0.54 = NS
Pain drawing categories (0–5)					
Mean category					
Exercise group	2.3	1.5	−0.8	−2.17	0.03
Ultrasound group	2.6	2.7	+0.1	0.18	0.86 = NS

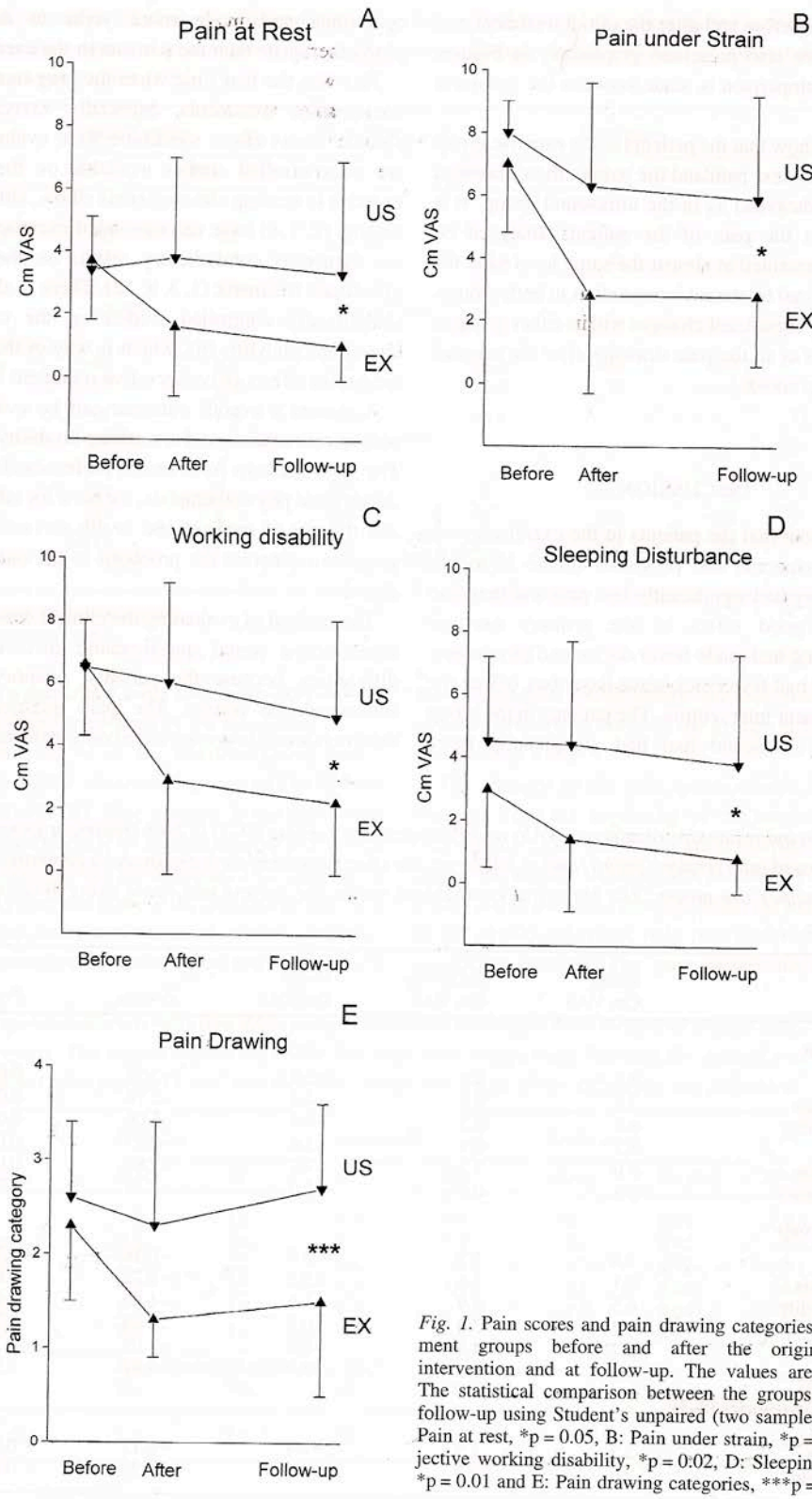

Fig. 1. Pain scores and pain drawing categories in both treatment groups before and after the original treatment intervention and at follow-up. The values are means (SD). The statistical comparison between the groups was made at follow-up using Student's unpaired (two sample) t-test (*). A: Pain at rest, *p = 0.05, B: Pain under strain, *p = 0.02, C: Subjective working disability, *p = 0.02, D: Sleeping disturbance, *p = 0.01 and E: Pain drawing categories, ***p = 0.0001.

before and after the initial treatment intervention and at follow-up, which means that the patients did not have such problems in replying. the postal questionnaire was a well-structured retrospective evaluation and the data on the patients' job situation and treatments given before the original intervention were available when the original treatment was started (11). This study hence also contains a prospective design for evaluating pain, which is mandatory for reliable results. Sick-leaves were also analyzed, using data from the database of the Social Insurance Institution of Finland and the number of operations obtained from the local hospital register. The more recent treatments and the current job situation are easier for the patients to record. Although the doctor and physiotherapy visits of the patients varied and the answers may include some errors, the best and most interesting results on job changes and the employment situation, sick-leaves, operations and pain results can be considered reliable, and they are all important as indicators of the disability and the effectiveness of treatments. The data from the Social Insurance Institution of Finland and from the local hospital register can also be considered reliable.

The real response to one method of treatment (exercise) and the effect of other activities or spontaneous healing on the outcome may be difficult to distinguish. The results show a prelimimary overall trend in the effectiveness of exercise compared to ultrasound. Exercise at the critical phase of prolonged tennis elbow symptoms may have the beneficial effect of preventing chronicity, because the pain scores of the patients at the end of the initial treatment and at follow-up were almost the same.

The patients in the exercise group were trained to do exercise, which prevented or minimized the harmful effects of immobilisation on the muscles and especially the insertion area, as shown by Tipton et al. (13).

The study sample consisted of the first 30 patients treated in a random sample (11), whose follow-up time was long enough to warrant longitudinal results.

The number of operations was evaluated for all the 30 patients, but the other results represent 76.6% of the sample, which is a satisfactory response rate in a postal inquiry.

The need for longitudinal studies on the effects of different treatments is apparent. The results of this study provide an interesting basis for discussing the cost-effectiveness of different therapies for the tennis elbow syndrome. The good long-term results seen in this study warrant the use of exercise instead of ultrasound. These patients seemed to have retained their arm function better and they had done more exercise as home treatment during the follow-up time than the patients in the ultrasound group, where exercise was done less frequently (Table III). Self-care and education of the patients may thus have an effect on the long-term physical outcome, as is shown by the results of the exercise group. The time needed to attain a good functional status in remobilisation is months rather than weeks in musculoskeletal tissue disorders (4), but in chronic tennis elbow syndrome the 8-week treatment resulted in a relatively good outcome. The patients were originally chronic, having several months' duration of symptoms and a poor response to traditional conservative treatment at the beginning of the original treatment. The exercise procedure used seems to prevent chronicity.

The group of patients in this study was relatively small, and any far-going conclusions must be made with special caution. The results can be considered to show a general tendency of the effects of these two treatments, as the groups were originally randomised. It is also interesting, that during the follow-up time, neither self-limiting nor spontaneous healing of the disorder was noted. The patients in the ultrasound group were in a poorer clinical condition at the end of the original treatment and some of them were operated. The effect of the exercise treatment used may be explained by controlled slow progressive loading, which may have beneficial effects on many of the components of the musculoskeletal system as muscles, tendons, ligaments and ligament-bone junction (4).

The results show that the exercise regime used in this study can be tried and recommended for the chronic tennis elbow syndrome. It requires the patients to be educated, but is a cheap method of treating prolonged tennis elbow symptoms.

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