

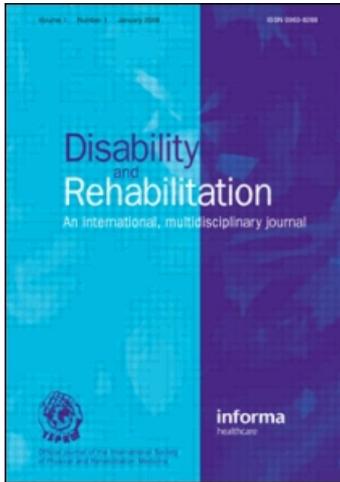
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# Treatment of patients with postpolio syndrome in a warm climate

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## Abstract

**Purpose:** Treatment in warm climate of various patient groups including patients with postpolio syndrome is controversial.

**Method:** Eighty-eight patients with postpolio syndrome (61 women) were recruited, stratified according to sex, age (above/below 60 years old) and use/not use of electrical wheelchair, and randomized to three groups. Group 1 ( $n=30$ ) underwent treatment in a rehabilitation centre in Tenerife for four weeks in November/December 1999. Group 2 ( $n=29$ ) were treated in two similar centres in Norway for the same period of time, while Group 3 ( $n=29$ ), the control group, followed their ordinary health care programme. All patients were tested at the start of study, and 3 and 6 months later, including physical tests and several questionnaire and qualitative interviews. Patients in Group 1 and 2 were also tested after the rehabilitation period.

**Results:** Group 1 and 2 improved significantly both in physical tests and subjective ratings. The positive effects in Group 1 tended to exceed the positive effects in Group 2, and the effects lasted longer. Six minutes walking distance in the two groups was 347 m and 316 m, respectively, before the treatment period, 429 m and 362 m immediately after, and 431 m and 356 m 3 months later. Subjective rating of pain (VAS-scale) was 42 and 43, respectively, before treatment, 17 and 31 immediately after, and 28 and 44 3-months later. In the control group, only minor changes were found.

**Conclusions:** The study seems to document a positive effect of treatment of patients with postpolio syndrome in warm climate.

## Introduction

Approximately 10 000 persons with sequelae after acute poliomyelitis are living in Norway. The majority of these persons is probably suffering from the 'second polio illness', i.e. the postpolio syndrome (PPS).<sup>1</sup> This

condition afflicts persons with polio sequelae 20–40 years after the acute stage of the disease.<sup>2</sup> PPS is characterized by increasing muscular weakness, aggravation in muscular and joint pain, symptoms of fatigue, progressive muscular atrophy, cold intolerance, and a decrease in the ability of taking care of oneself. A serious late complication is difficulty in breathing.<sup>3,4</sup> In addition, co-morbidity, such as osteoarthritis, diabetes type II, hypertension and cardiac diseases, are common among PPS individuals.<sup>5</sup>

A large number of Norwegians with PPS have reported that staying in countries with warmer climate for a period of time has had positive effects on their health problems.<sup>6</sup> However, there is a lack of scientific publications on treatment of PPS patients in warmer climate. Thus, the purpose of the present study was to compare treatment for patients with PPS in a rehabilitation centre in a warm climate versus treatment in a Norwegian rehabilitation centre during the winter season. The authors also wanted to compare the treatment effects in these two groups with a control group. This third group of PPS patients was asked to participate in the study and live as usual. There were therefore, three comparable groups of persons with PPS involved in the project.

The overall purpose of the study was to obtain knowledge whether treatment in a warmer climate had effects on physical, psychological and social dimensions of health in persons with PPS. The tests and questionnaires were conducted before and at the end of the treatment period of 4 weeks, as well as 3 and 6-months following the intervention.

## Method

### SUBJECTS

In total 175 persons who fulfilled the criteria of PPS<sup>4</sup> were invited to participate in the study. These patients were consecutively chosen from previously registered

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patients with PPS at Sunnaas Rehabilitation Hospital. Exclusion criteria were other medical conditions that could influence the rehabilitation programme, such as serious cardiovascular diseases, serious psychiatric conditions, and alcohol or drug addictions. Out of these 175 persons, 109 were accepted to participate in the study. However, 20 persons dropped out for different reasons before the study started, and one more person left the study the first day after it started. Thus, in total, 88 persons were included and the whole study was completed in a period of 6 months, lasting from November/December 1999 until May/June 2000.

The participants were 61 women and 27 men with an average age of 58 years (range 33–75 years). They suffered from acute poliomyelitis at an average of 7 years (1–26 years), and reported new polio-related symptoms at a mean of 37 years (range 27–67 years) after the acute disease. Most of the subjects suffered from severe polio sequelae with muscular paresis and were in need of orthopaedic devices and technical aids. Eleven persons used manual wheelchairs, and 17 persons had electric wheelchairs. Forty-nine persons (56%) had other, not polio-related, diseases. These were diseases that did not interfere significantly with the training, such as mild hypertension, osteoarthritis, diabetes mellitus, chronic allergy or obstructive lung disease. Fifty-eight persons (66%) used prescribed medicine.

#### PROCEDURE

The subjects were randomized into three groups, stratified according to gender, age (above/below 60 years), and dependent/not dependent on an electric wheelchair. Group 1 (Tenerife group,  $n = 30$ ) was treated at a rehabilitation centre in Tenerife, a Canary Island (Vintersol). Group 2 (Norway group) was treated in the same time period as inpatients at two Norwegian rehabilitation centres (Hokksund Kurbad,  $n = 14$  or Vikersund Kurbad,  $n = 15$ , respectively). Group 3 (control group,  $n = 29$ ) lived as usual besides participating in the test procedures. Most of these had one or two physiotherapy and/or swimming sessions or other physical activities per week, while some of them had no physiotherapy or training at all. After the treatment period there was no further intervention in any group. The follow-up period was 6 months in all groups, until May/June 2000, when the summer period started.

#### TREATMENT

The three institutions involved offered their ordinary programmes adapted for PPS subjects during the

intervention period. However, to ensure similar treatment at the three centres, professionals from the Sunnaas Rehabilitation Hospital discussed and repeated the main principles for treatment of PPS subjects with the professionals at the involved rehabilitation centres.

The PPS subjects in the two intervention groups (Tenerife and Norway group) received a combination of individual and group therapy. All centres had a swimming pool, and also classes in relaxation techniques, self-training and gymnastics. In addition, each subject was prescribed an individually adapted training programme based on his or her functional level. Most subjects attended daily treatment in the swimming pool (45 min) and physiotherapy (30 min), while the other treatments were offered individually. Thus, the PPS subjects had a somewhat different number of individual treatments during the intervention period.

The climate in Tenerife was mostly dry and sunny, with temperatures around 25°C, while the climate in Norway during the intervention period was mainly rainy or snowy, with temperatures  $\pm 0^\circ\text{C}$ . Thus, the Tenerife group spent most of the time outside, with much of the therapy arranged outdoors, while the subjects who attended the Norwegian rehabilitation centres (Group 2) were indoors most of the time.

#### EVALUATION

The outcome measures aimed to cover the three levels of the WHO's defined consequences of disease; impairment, disability and handicap.<sup>7</sup> The examinations involved the following questionnaires and physical tests, shown in table 1: subjective pain,<sup>8</sup> Fatigue Severity Scale,<sup>9</sup> Ursin, Holger inventory,<sup>10</sup> Beck's depression inventory (BDI),<sup>11</sup> life satisfaction scale,<sup>12</sup> Sunnaas ADL-index,<sup>13</sup> Rivermead mobility index,<sup>14</sup> spirometry,<sup>15</sup> Grippit hand grip test,<sup>16,17</sup> 6-min walking/wheelchair test,<sup>14</sup> 20 m fast walking<sup>14</sup> and function test ('timed up and go').<sup>18</sup> The information from Group 1 and 2 was collected immediately before and after the treatment, and 3 and 6 months later. Information from the control group was collected when the two other groups started their treatment, and 3 and 6 months later.

Immediately after the treatment the subjects in Group 1 and 2 evaluated which part of the programme they appreciated most: physiotherapy, swimming-pool, relaxation, self training, group supervision, social activities, climate or environment. They rated 1st, 2nd and 3rd priorities which gave 3, 2 and 1 points, respectively.

**Table 1** Variables and outcome measures among the polio subjects before and after a 4-week intervention period, and 3 and 6 months afterwards

<i>Outcome measures</i>	<i>Questionnaire/test</i>
Pain	Subjective pain <sup>8</sup>
Fatigue	Fatigue Severity Scale <sup>9</sup>
Health Related Problems	Ursin, Holder Inventorium <sup>10</sup>
Depression	Beck's Depression Inventory (BDI) <sup>11</sup>
Life satisfaction	Life Satisfaction Scale <sup>12</sup>
Activities in Daily Life (ADL)	Sunnaas ADL-index <sup>13</sup>
Mobility	Rivermead Mobility Index <sup>14</sup>
Lung function	Spirometry, Micro Plus Spirometer, Micro Medical Limited, P.O. Box 6, Rochester, USA <sup>15</sup>
Handgrip strength	Gripping Deluxe Hand Dynamometer Jamar Limited <sup>16,17</sup>
Endurance	6 min walking-/wheelchair test <sup>14</sup>
Walking	20 min fast walking <sup>14</sup>
Movement	Function test ('timed up and go') <sup>18</sup>

#### INTERVIEWS

Focus group interviews were performed with all the subjects in the two treatment groups. Some individual depth interviews (qualitative interviews) were made with a randomized and stratified selection of subjects.

#### DATA PROCESSING

Quantitative data were analysed by SPSS (statistical package for social sciences). The three different groups were compared before treatment, using the t-test, chi-square, and the Mann-Whitney u-test. Data collected before and after intervention were compared with paired t-test or Wilcoxon's non-parametric test within each group. The two groups that received treatment were compared with an unpaired t-test or Mann-Whitney u-test before and after intervention, and the difference before and after intervention was statistically analysed the same way. Paired tests were used to compare the results 3 and 6-months later within all groups, and unpaired tests were used between the groups. The Bonferroni correction was used in the discussion of the statistical results of outcome measures. Chosen level of significance was <0.05.

Qualitative data from the focus group interviews and depth interviews were presented as part of the discussion.

#### Results

The results before treatment from the questionnaires showed that the involved group of subjects with PPS

reported a lot of difficulties and problems, demonstrating that these subjects had serious health problems. For example, pain assessment showed that only four subjects reported no pain during the last week, while the mean value of subjective pain was 41 on the VAS scale (0 = no pain, 100 = unbearable pain). Forty-eight subjects (55%) reported cases of depression, i.e. a score above nine on the Beck depression inventory (BDI 0–63). The mobility, walking and hand-grip tests showed markedly reduced mean values compared with corresponding results in healthy persons.

There were no significant differences in sex distribution, age, and usage of electric wheelchair between the three groups. When comparing all measured parameters before intervention between the three groups, the control group was significantly better in ADL, mobility and walking tests than the Norway group. The control group was also significantly better in 6 min walking than the Tenerife group. Apart from these differences there were initially no significant differences between the groups. Thus, the three groups were seemingly as comparable as possible in such a clinical trial.

The results of the trial are presented in tables 2–5 and figure 1. During the intervention, the Tenerife group improved in more parameters than the Norway group, actually in all parameters apart from ADL and some lung function variables. The Norway group improved in health-related problems, depression, strength, physical function tests and pain.

As seen in figure 1 and table 2 both treatment groups reported less pain after intervention. The Tenerife group still reported significantly less pain 3-months later, and the Tenerife group reported significantly less pain than the Norway group both immediately after and 3-months after the intervention. There were no significant changes in reported pain in the control group during the same period of time.

As seen in table 3 the Tenerife group also reported significant improvement in fatigue, health related problems and depression after treatment, and the differences between the Tenerife and the Norway group became significant regarding health related problems and depression, both immediately and 3-months later. Only the Tenerife group reported significantly reduced fatigue after treatment, and this effect was still present 6-months later. Both the Norway and the Tenerife groups reported significantly less depression after treatment. The Norway group had lost this effect after 3 months. The control group also reported significantly less depression after 3 and 6-months compared with the results of the first test.

**Table 2** Subjective rating of pain in the Tenerife, Norway and control group. Values are given in median (range) and mean (1 SD), respectively, for pain 1–6 and pain 0–100. Statistically significant differences from before treatment are given horizontally. Differences between groups are given below

	<i>Before treatment</i>	<i>After treatment</i>	<i>3 months later</i>	<i>6 months later</i>
<i>Tenerife group</i>				
Pain 1–6	3 (1–5)	2*** (1–5)†	3** (1–4)	3** (1–4)‡
Pain: VAS 0–100	42 (22)†	17*** (18)†	28** (25)†	36 (25)
<i>Norway group</i>				
Pain 1–6	3 (1–6)	3*** (1–5)‡	3 (1–5)‡	3 (1–5)‡
Pain: VAS 0–100	43 (24)§	31*** (23)§	44 (24)¶	44 (26)¶
<i>Control group</i>				
Pain 1–6	3 (1–4)		3 (1–4)	3 (1–5)
Pain: VAS 0–100	40 (19)		33 (21)	35 (23)
<i>Pain 1–6</i>				
<i>Between the groups:</i>				
Tenerife–Norway	NS	*	*	NS
Tenerife–control	NS		NS	NS
Norway–control	NS		NS	NS
<i>Pain: VAS 0–100</i>				
<i>Between the groups:</i>				
Tenerife–Norway	NS	*	*	NS
Tenerife–control	NS		NS	NS
Norway–control	NS		NS	NS

Participants: †n = 29; ‡n = 28; §n = 27; ¶n = 26; \*p ≤ 0.05; \*\*p ≤ 0.01; \*\*\*p ≤ 0.001

The endurance test showed how many metres the subjects could walk or use a manual wheelchair in 6 minutes. Before the start the control group had significantly better results than the two other groups. However, the control group did not improve in later tests, while the Tenerife group improved significantly during the treatment period, and the effect lasted 3 and 6-months afterwards. As seen in table 4 the Norway group also improved during the intervention, and this result lasted for 3 months, while there was no effect left after 6 months.

The function test ‘timed up and go’ measures the time it takes for the subject to raise from a chair, walk 3 metres, turn and return into the chair. Initially, the control group performed better than the other groups in the function test ‘timed up and go’ (table 4). The Norway group performed better in this test both after the treatment and 6-months later. The Tenerife group improved to the same level as the control group during intervention and kept the same level during the following 6 months.

As seen in table 5 the results of the strength test ‘hand-grip’ showed improvement, both in the Tenerife group and in the Norway group. Even if there was a tendency towards more pronounced improvement in the Tenerife group, there were no significant differences between the groups.

Only the Tenerife group reported a significant improvement in life satisfaction after intervention, both satisfaction with life as a whole and satisfaction with their physical and mental health. The effects lasted less than 3 months. There was also found a transient improvement in lung function parameters during intervention in the Tenerife group only, while ADL-function and Rivermead Mobility Index showed minor changes in all three groups during the study period.

Qualitative data supported the quantitative results, as both groups reported positive experiences during the treatment period. However, the individual enthusiasm and reports of improved health were more pronounced in the Tenerife group.

In the subjective rating of the different parts of the programme physiotherapy got the highest score, both in the Tenerife and in the Norway group. In the Tenerife group the climate scored second, followed by the swimming pool and the social activities. In the Norway group the swimming pool scored second followed by social activities and self-training.

In the Tenerife group, many of the positive effects lasted 3 and 6-months after treatment. The Norway group were almost back to the pre-treatment level after 3 months. However, 6 months after intervention the BDI score was better than the initial score. The same

**Table 3** Fatigue, health related problems, and depression in the Tenerife, Norway and control group. Statistical differences from before treatment are given horizontally. Differences between groups are given below

	Before treatment	After treatment	Median (range) 3-months later	6-months later
<i>Tenerife group</i>				
Fatigue severity scale 1–7	6.1 (3.7–7.0)	5.1** (1.7–7.0)	5.3*** (2.3–7.0)	5.4* (2.0–7.0)†
Health related problems (UHI)	21.5 (5–44)	11*** (2–34)	14*** (0–32)‡	18 (1–39)‡
Depression: Beck	8.5 (0–27)	3*** (0–19)	3*** (0–22)	4.5*** (0–20)‡
<i>Norway group</i>				
Fatigue severity scale 1–7	5.6 (2.2–7.0)	5.7 (2.6–7.0)	5.9 (3.2–7.0)‡	5.4 (2.9–7.0)
Health related problems (UHI)	23 (2–45)	16*** (2–41)	20 (7–40)§	20.5 (2–56)†
Depression: Beck	10 (0–44)	6*** (0–41)	7 (2–37)‡	6** (0–38)
<i>Control group</i>				
Fatigue severity scale 1–7	6.0 (3.1–7.0)		6.2 (3.2–7.0)	5.9 (2.1–6.9)
Health related problems (UHI)	19.5 (6–37)‡		16 (3–41)	18 (5–44)
Depression: Beck	10 (1–25)		6* (2–25)	7* (0–21)
<i>Fatigue severity scale 1–7 between the groups:</i>				
Tenerife–Norway	NS	NS	NS	NS
Tenerife–control	NS		NS	NS
Norway–control	NS		NS	NS
<i>Health related problems between the groups:</i>				
Tenerife–Norway	NS	**	*	NS
Tenerife–control	NS		NS	NS
Norway–control	NS		NS	NS
<i>Depression: Beck between the groups:</i>				
Tenerife–Norway	NS	*	**	NS
Tenerife–control	NS		*	NS
Norway–control	NS		NS	NS

Participants: †n = 29; ‡n = 28; §n = 27; \*p ≤ 0.05; \*\*p ≤ 0.01; \*\*\*p ≤ 0.001

phenomenon was found in the control group, while this group in general showed only minor changes throughout the trial period.

## Discussion

This study indicates significant health effects when persons with PPS receive treatment during 4 weeks in a rehabilitation centre, both in Norway and in Tenerife. The results in the Tenerife group, however, were significantly better in several parameters. The effects of the treatment in Tenerife lasted at least 3 months, while it lasted shorter than 3 months for most of the parameters in the Norway group.

These PPS subjects reported new muscular weakness and atrophy, they suffered from pain, fatigue and depression, and many of them were in need of canes, crutches and wheelchairs, as well as in need of assistance and adaptations. Per definition, their health condition

was deteriorating. Therefore, it was a rather positive surprise that they reported such a good response during a 4-week treatment period. This might indicate that most persons with PPS still would profit on rehabilitation. The treatment philosophy of subjects with PPS has been that their physical condition will not improve, so the effort should be put on reducing their level of activity and increasing technical aids, help and support.<sup>19</sup> Thus, rehabilitation has been concentrated on life style modification and energy conservation. The results of this study might indicate that this treatment strategy has been too passive.

After treatment, the Tenerife group became significantly better than the Norway group concerning pain, health related problems, depression and life satisfaction. These differences lasted for 3 months for the three first mentioned parameters. As the groups did not differ significantly before intervention, and the interventions were similar in the two groups, one would believe that

**Table 4** Physical function in the Tenerife, Norway and control group. Statistical significant differences from before treatment are given horizontally. Differences between groups are given below

	Before treatment	After treatment	Mean (SD) 3 months later	6 months later
<i>Tenerife group</i>				
6 min walking test (m)	347 (119)†	429*** (147)†	431*** (124)†	425*** (135)†
20 m walking test (sec)	19 (9)†	15*** (5)‡	15*** (5)†	16* (6)‡
Timed up and go (sec)	11 (5)†	8*** (3)‡	8*** (3)†	8*** (3)‡
<i>Norway group</i>				
6 min walking test (m)	316 (149)§	362** (140)§	356** (160)¶	331 (160)¶
20 m walking test (sec)	21 (7)§	19** (7)§	20 (8)¶	20 (7)¶
Timed up and go (sec)	12 (5)††	10*** (4)††	10* (4)‡‡	10*** (4)‡‡
<i>Control group</i>				
6 min walking test (m)	414 (120)‡		410 (127)‡	437** (123)‡
20 m walking test (sec)	15 (7)‡		16 (6)‡	15 (6)‡
Timed up and go (sec)	8 (3)‡		8 (3)‡	8 (3)‡
<i>6 min walking test (m) between the groups:</i>				
Tenerife–Norway	NS	NS	NS	*
Tenerife–control	*		NS	NS
Norway–control	*		NS	
<i>20 m walking test (sec) between the groups:</i>				
Tenerife–Norway	NS	NS	NS	NS
Tenerife–control	NS		NS	NS
Norway–control	*		*	*
<i>Timed up and go (sec) between the groups:</i>				
Tenerife–Norway	NS	NS	NS	NS
Tenerife–control	NS		NS	NS
Norway–control	**		*	*

Participants: †n = 27; ‡n = 26; §n = 23; ¶n = 23; ††n = 22; ‡‡n = 29; \*p ≤ 0.05; \*\*p ≤ 0.01; \*\*\* ≤ 0.001

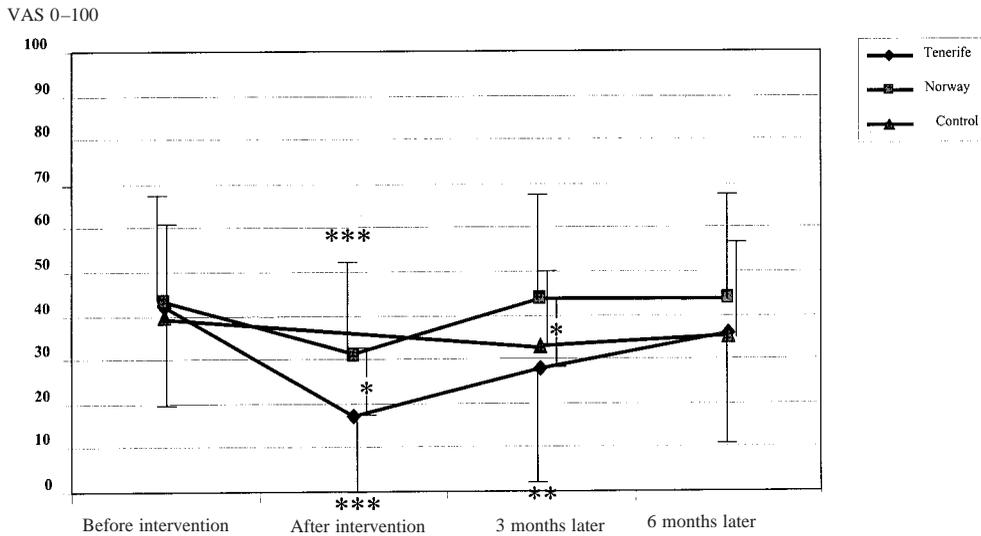
**Table 5** Handgrip strength test in the Tenerife, Norway and control group. Statistical significant differences from before treatment are given horizontally

	Before treatment	After treatment	Mean (SD) 3-months later	6-months later
<i>Tenerife group</i>				
Handgrip right (% pred.)	43 (20)†	51*** (20)‡	68*** (30)†	60*** (32)‡
Handgrip left (% pred.)	43 (17)†	51*** (16)‡	62*** (27)†	58*** (25)‡
<i>Norway group</i>				
Handgrip right (% pred.)	49 (26)§	57** (28)§	61*** (27)¶	56* (28)¶
Handgrip left (% pred.)	44 (23)¶	51** (28)¶	61*** (29)††	53* (28)††
<i>Control group</i>				
Handgrip right (% pred.)	60 (33)‡		66* (34)§	59 (35)§
Handgrip left (% pred.)	53 (27)‡		56 (30)‡	49 (28)‡

Participants: †n = 28; ‡n = 27; §n = 26; ¶n = 25; ††n = 24; \*p ≤ 0.05; \*\*p ≤ 0.01; \*\*\* ≤ 0.001

the warmer climate had influenced the results. Are there any mechanisms that make the combination of hot and sunny climate and physical treatment better than treat-

ment without the climate effect in PPS subjects, as presumed in rheumatic patients?<sup>20</sup> The Tenerife group reported that they 'felt softer' in their muscles and joints,



**Figure 1** Subjective rating of pain (VAS 0–100) in the Tenerife, Norway and Control group before and after intervention, and 3 and 6 months later. Values are presented in mean  $\pm$  1 SD. Significance level from before intervention is indicated by \* above/below the figures. Significance level between the groups is indicated by \* vertically in the figure \*  $p \leq 0.05$ ,  $p \leq 0.01$  \*\*\* $p \leq 0.001$ .

had less pain than at home, and therefore could be more mobile and active. It is well known that heat helps against pain for muscle and skeletal problems. However, it is also known that heat alone is not sufficient to gain permanent effects. Therefore, one would presume that the warm climate itself gives a better warming-up before the more effective treatment; exercises, stretching, walking, swimming and other physical activities.

It is important to take into account the positive psychosocial effects of some days off in warmer surroundings, using summer-time clothes, spending the time together with fellow men, and participating in the social life. This seemed to be especially important for improving psychosocial parameters such as depression and life satisfaction.

The results concerning pain, fatigue, depression, and physical tests showed that the Tenerife group still had improved values 6 months after treatment, while the Norway group only had some physical tests maintained improved after 6 months. After the intervention, the daily activities and stress seemed to overwhelm the Norway group faster than the Tenerife group. The Tenerife group was also more enthusiastic than the Norway group during the focus group interviews. Some told about severe physical pain that had disappeared or weakened for a longer period of time. Others reported that their functions, both physical and mental, were much better at home afterwards. Many of the subjects reported special benefit of being together with fellow men during a period of time. Some of them planned to

establish a new home in a warmer climate or to go on holiday in warmer climate during their next winter season in Norway.

The control group did not get any special treatment, and it was not possible to intervene with their regular treatment programme or isolate them from other impressions. There was a significant reduction in the BDI score from November/December to May/June, and it is tempting to correlate reduced depression to the warmer climate during summertime in Norway.

The control group also had better endurance after 6 months compared with the first walking test. It is well known that many PPS subjects stay inside during wintertime. Improved endurance can therefore be interpreted as an effect of more physical outdoor activities during springtime.

Treatment programmes in warmer climates for subjects with PPS will only represent a small part of a comprehensive treatment for this group. The interviews clearly showed that the local environment was the most important. Thus, they had a continuous need of help and support, technical aids, regular treatments, follow-ups, continuity and social security.

The average of PPS subjects in Norway is increasing, probably approaching 60 years.<sup>1,6</sup> This indicates that there will be an increasing number of subjects with contraindications for travelling to a warmer climate for treatment. However, they can still be in need of, and profit from, similar treatment in Norway. The treatment results from the two Norwegian rehabilitation

centres showed that it is possible also to make an effective programme within the existing system. Such treatment programmes should, according to the present results, be organized in groups for PPS subjects. The disadvantage today is the high costs to be paid by patients themselves for such a treatment. In the present project, it was found that the total treatment costs in Norway were comparable with the travel and treatment expenses in Tenerife.

## Conclusion

Subjects with PPS had a considerable health profit during 4 weeks of wintertime treatment, both in rehabilitation centres in Norway as well as in Tenerife. The positive effects, however, were more pronounced in Tenerife, and the effects lasted at least 3 months afterwards in the Tenerife group, while the duration of the effects was shorter for most parameters in the Norway group. The control group showed minor changes during the same period. The present results give support to a more active treatment for PPS patients, including treatment in a warmer climate during wintertime for selected patients.

## Acknowledgements

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## References

- 1 Wekre LL, Stanghelle JK, Lobben B, Øyhagen S. The Norwegian Polio Study 1994: a nation-wide survey of problems in long-standing poliomyelitis. *Spinal Cord* 1998; **36**: 280–284.
- 2 Ahlström G, Karlsson U. Disability and quality of life in individuals with postpolio syndrome. *Disability and Rehabilitation* 2000; **22**: 416–422.
- 3 Halstead LS, Rossi CD. New problems in old polio patients. Results of a survey of 539 polio survivors. *Orthopedics* 1985; **8**: 845–850.
- 4 Halstead LS, Wiecherers DO. Research and clinical aspects of late effects of poliomyelitis. *Birth Defects* 1987; **23**: 301–312.
- 5 Schanke AK, Stanghelle JK. Fatigue in postpolio patients. *Spinal Cord* 2001; **39**: 243–251.
- 6 Lobben B, Øyhagen S. *The Norwegian Polio Study 1994*. Oslo: The National Society of Polio Victims (LFPS), 1995.
- 7 WHO. International Classification of Impairment, Disabilities and Handicaps. *A Manual of Classifications Relating to the Consequences of Disease*. Genève: WHO, 1980.
- 8 Carlsson AM. Assessment of chronic pain. Part 1: aspects of the reliability and validity of the visual analogue scale. *Pain* 1983; **16**: 87–101.
- 9 Krupp LB, Larocca NG, Muir-Nash J, Steinberg AD. The fatigue severity scale. *Arch Neurol* 1989; **46**: 1121–1123.
- 10 Juel NG. (ed.) *Norsk fysikalsk medisin*. Oslo: Fagbokforlaget, 1999.
- 11 Beck AT, Ward CH, Mendelson M, Mock J, Erbaugh H. An inventory for measuring depression. *Arch Gen Psychiatry* 1961; **4**: 561–571.
- 12 Fugl-Meyer AR, Brenholm J-B, Fugl-Meyer K. Om livstillfredsstillelse, lycka, rehabilitering. *Socialmedicinsk Tidsskrift* 1992; **1**: 33–41.
- 13 Vardeberg K, Kolsrud M, Laberg T. The Sunnaas Index of ADL. *World Federation of Occupational Therapy Bulletin* 1991; **24**: 30–35.
- 14 Wade DT. *Measurement in Neurological Rehabilitation*. Oxford: Oxford University Press, 1992.
- 15 Vitalograf Ltd. *Tables of Normal Values for Lung Function*. Buckingham: Moreton Press, 1980.
- 16 Mathiowetz V, Weber K, Volland G, Kashman N. Reliability and validity of grip and pinch strength evaluations. *J Hand Surg* 1984; **9A**: 222–226.
- 17 Nordenskiöld UM, Grimby G. Grip force in patients with rheumatoid arthritis and fibromyalgia and in healthy subjects. A study with the Grippit instrument. *Scand J Rheumatol* 1993; **22**: 14–19.
- 18 Podsiadlo D, Richardson S. The timed 'up and go': a test of basic functional mobility for frail elderly persons. *J Am Geriatrics Soc* 1991; **39**: 142–148.
- 19 Berlly MH, Strauser WW, Hall KM. Fatigue in Postpolio Syndrome. *Arch Phys Med Rehabil* 1991; **72**: 115–118.
- 20 Guedj D, Weinberger A. Effect of weather conditions on rheumatic patients. *Annals of the Rheumatic Diseases* 1990; **49**: 158–159.