Clinical Studies
Utilising the
Active Passive Trainer (APT)

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SUMMARY

Summarised below, through text extract, are findings and information on the clinical studies performed. We have referenced each statement to the relevant study.

⇒ “The tricycle is a mobility tool with which children are familiar and which they love. The possibility to provide handicapped child with a mobility tool, which at the same time serves him as a game and fits his surroundings, removes a great emotional impediment to the child's use of such an aid.” (Page 2: The Tricycle as a mobility tool for the child with Brain Damage)

⇒ “5 dimensions of the disabling process, pathophysiology, impairments, functional limitations, disabilities and societal limitations. In conclusion, it may be said that, appropriate exercise in mobility, strength and endurance may help to improve, or maintain the functional ability of the older or frail person or people with various pathologies.” (Page 5: Exercise with the Active Passive Trainer - A Professional Background)

⇒ “In this study we have shown that a program of exercise on the APT (exercise against resistance) considerably improves the walking rate in the elderly and frail. Furthermore there is an improvement in level of independence when performing daily activities.” (Page 7: Effects of exercising with an Active Passive Trainer on the rate of mobility of frail elderly residents of retirement homes)

⇒ “APT, which we used for this research, is the excellent upper extremity ergometer for training, setting the load with the combination of 5 different load levels and the various rpm. The correlation between VO2 and the load was 0.912 (r=0.912) with our research result and showed very high correlation.” (Page 10: Experience with Active Passive Trainer (APT))

⇒ “Of the 20 patients in the house:
  o Three did not commence treatment at all - two lay prone in wheelchairs, and reacted pathologically.
  o Three train completely independently with the device.
  o Three train with the device, alternating from side to side.
  o Four train on both sides, but require constant support and accompaniment.
  o Five require only minimal supervision and support.
  o Three are treated lying down as well as sitting up. (Page 13: Project for the Development of Programs for Sheltered Welfare Patients)

⇒ “It must be noted that each of the group members expressed much satisfaction with the machine and its operation, and all them would like to have the machine remain at their disposal.” (Page: 15 Tracking the use of APT Active / Passive Exercise machine: Sample group of army disabled)
1) The Tricycle as a mobility Tool for the child with Brain Damage
Levitus C., (physiotherapy), Dar M., Keren Y (physiotherapy)
ALYN - Children Rehabilitation Medical Center, Jerusalem Israel.

Introduction - Presentation of the Topic:
Mobility is one of the most basic and vital human functions. The purpose of adjusting a mobility tool to a handicapped person is to allow the person to achieve maximum functional efficiency (1). The ability to function with the proposed apparatus depends on the physiological, motoric and cognitive attributes and reserves of the handicapped person, on the one hand, and on the physical and social conditions of his environment on the other hand (2).

The tricycle is a mobility tool with which children are familiar and which they love. The possibility to provide handicapped child with a mobility tool, which at the same time serves him as a game and fits his surroundings, removes a great emotional impediment to the child's use of such an aid.

Clinical observations have shown that children, who use aids such as a walker or wheelchair to get around, move more rapidly and with greater energetic efficiency on a tricycle than with their personal mobility tool. We also observed children who were absolutely immobilized when using ordinary means but rode independently over great distances on a tricycle. The literature does not contain much information regarding the use of the tricycle as a therapy and mobility tool for children. One of the few studies published, which examined the efficacy of exercising with a tricycle for strengthening the extensors of children with cerebral palsy, describes the children's obvious enjoyment of tricycle riding (3).

Object of the Study: To examine the possibility of using the tricycle as an effective mobility tool for the mobility-challenged child.

Specific aims:
1. To measure the energetic efficiency of a tricycle adjusted to a handicapped child, against his personal mobility tool.
2. To evaluate the functional benefit from using the tricycle as a mobility tool for children: distance and speed of mobility with the tricycle as compared to the child's personal mobility tool.
3. To determine the degree of functional independence conferred by the mobility tool (tricycle versus personal mobility tool) Contribution to ALYN: An objective examination of a new approach to mobility therapy and adjustment in handicapped children. The mobility adjustments can be made at the ALYN laboratory.

Population and Methods:

Population:
Fourteen children suffering from central brain damage, cerebral palsy and severe post-traumatic brain injury, including children with dystonic, ataxic and spastic symptoms and slight to severe forms of hemiplegia and quadriplegia. The study will include children who use an aid to get around (aid: wheelchair, walker, crutches).

Work and Evaluation Methods:
The adjustment of a tricycle to a child will be done by means of a system consisting of two parts:
The first - a fixed seat elevated about a meter above the ground. The second - the APT (Active Passive Trainer) wheel of Kibbutz Tzora.

The wheel will be installed on a frame enabling the entire apparatus to move up, down, forwards and backwards (relative to the seat). Various pedal lengths and thigh supports can be adjusted to the wheel.

Adjustment method: Each child will try out three initial basic positions: straightened hip extensor (0º), bent hip extensor (90º) and intermediate position (45º). In each position the child will try out different rotation axes: minimal knee movement, intermediate state, and maximal knee movement.

The order of the tests will be set at random for each child between and during positions. Each position will be given a pedalling adjustment period of 30 minutes, after which the child will pedal for another 30 minutes.

Criterion for determining the optimal wheel: Heart rate/number of rotations per unit time (minimum ratio). Based on the "prescription" obtained, a tricycle will be adjusted to the child.

Word method: On the day of adjustment of the tricycle, the child will undergo, in addition, a short training session in which he will be taught how to mount and dismount from the tricycle and practice moving by means of the tricycle along the hospital's corridors.

Each child will undergo a series of evaluations (described below) with his personal mobility tool and with the adjusted tricycle. The evaluation procedure in respect of each mobility tool will be performed on separate days. The time of the procedure during the day and the order of the evaluations will remain the same.

Evaluation methods:
1. Measurement of the heart rate at rest and in action by means of a polar pulse, for calculating the energy consumption index (according to the difference between the pulse in action and at rest dividing by the speed of mobility comfortable speed for the child and maximum speed, see par. 2)
2. Speed mobility: Mobility at a comfortable speed, and mobility at a high speed along a course of 12m. The middle 10m will constitute the distance for measurements of the child's speed of mobility using the tricycle and his mobility tool.
3. Distance of mobility: along the hospital corridor. The child will be asked to move until he feels tired (grade 13 on BORG scale - somewhat difficult).
4. Functioning around the mobility tool. Specific function:

Accessing the mobility tool from a chair' and vice versa.
Accessing the WC: entry, transit, exit.
Accessing of dining table: functioning in a table environment.
The performance will be graded according to the FIM categoric scale.

Bibliography:
A model describing the disabling process has recently been published, as a modification of the World Health Organization's International classification of impairment, disability and handicap (1980).

This model was produced jointly by the National Center for Medical Rehabilitation and National Institutes of Health in 1993, and offers 5 dimensions of the disabling process, pathophysiology, impairments, functional limitations, disabilities and societal limitations.

1. Pathophysiology: Underlying medical or injury processes at cellular and tissue levels.
2. Impairment: Organic and systemic disorders, which may potentially impair function of the organism or person. Impairment may not be recognized at the site of lesion, but result from it. It must be remembered that impairments can lead to further (secondary) impairments.
3. Functional limitations: A combination of impairments in one or more systems may lead to functional limitations. They involve whole body function.
5. Societal limitations: Referred to as "handicap" by the WHO - resulting when societal barriers prevent the individual from functioning at the highest level he or she is capable of achieving.

The daily functions of man demand movement. Control of movement demands cooperation between the nervous, muscular, connective tissue and skeletal systems. For normal function, besides control of the nervous system, a person needs muscle power and endurance, full range of movement of the joints, muscles, ligaments, connective tissue and the nervous system.

Moving synovial joints prevents biomechanical and histological changes in the soft tissues around the joint, and decreases elasticity of the capsule and ligaments (Akeson et al 1980). This allows free movement and, in other words, can decrease impairments and delay or avoid secondary impairments. A muscle kept in a shortened position for a long period shows:

a) Changes in its composition - loss tissue protein (William & Goldspink 1978) loss of sarcomere (component of muscle fiber) and increased amounts of connective tissue;

b) Increased passive-elastic stiffness (William & Goldspink 1978, 1984), causing remodelling of connective tissue to match the new, shortened muscle length. This restriction of movement (Light et al 1984) causes impairment, which, if prevented, would not lead to secondary impairment.

Muscle contraction causes normal tension on bone to which it is connected, affecting bone density (Bassett 1977) and preventing osteoporosis. Osteoporosis often appears following long periods of immobility. In order to develop muscle strength, it is necessary to exercise enables tired muscle to revive and, together with improved muscle strength, endurance increases.
**Connective tissues and skin:** Non-mobile connective tissue has a tendency to shorten (Kisner & Colby 1987), as does the skin, e.g. scar tissue following burns or other tissue damage (trauma or surgery). This also may lead to contractures - in other words impairment.

**The nervous system:** The entire nervous system is a continuous tissue tract. It forms an (Butler 1991), which means that a restriction appearing in one part of the body may cause limitation in another part of the body. Movement also influences the interaction between the nervous system and other tissues in the body. Nerve cell send messages to target tissues in various ways (electrical and chemically). One method of transport is via the axoplasm (the substance within the axon) from the nerve cell to target tissue.

These messages are responsible, amongst other things, for the well being of the target tissue. The target tissue itself also sends messages to the nerve cell via the axoplasm, regarding its condition. The axoplasm is a viscous substance, which, amongst other characteristics, can change its viscosity - is lower when the nerve is moving, enabling the messages to transfer normally. If man does not move the viscosity of the axoplasm increases and the speed of transport is greatly reduced, slowing down the messages sent in both directions, and ultimately causing trophic changes in the target tissue.

There are various factors influencing balance, which are very important to consider in order to prevent falls (especially in the frail person). Besides the sensory systems (vestibular, visual, somato-sensory), many other systems affect balance e.g. the effects of range of movement of joints and soft tissues and muscle strength (Shumway-Cook 1994).

**General Physical Fitness:** To develop or improve general physical fitness (cardiovascular system) it is necessary to activate large groups of muscles for between 15-45 minutes or more (Fox & Mathews 1987, Kisner & Colby 1987). Thus it can be concluded that, fulfilling functional demands requires passive and active elements. Passive movement (at varying speeds) should be available, while maintaining safety of moving joints. Active movement should be graded and use different muscle groups. To attain this, a suitable mechanical device may be used.

Many people over the age of 65 display symptomatic, degenerative changes in different joints. For example - osteoarthritic changes in the knee cause pain, reduction in movement and function leading to contractures and muscle wasting (secondary impairment) (Coni et al 1988). Increasing age (often accompanied by less active life style) causes loss of nerve cells, loss of muscle mass, muscle wasting, and reduction of elasticity of lung tissue (which in turn causes reduction of lung capacity and function). In other words, there is impairment, which, if not attended to, will develop into secondary impairment.

In conclusion, it may be said that, appropriate exercise in mobility, strength and endurance may help to improve, or maintain the functional ability of the older or frail person or people with various pathologies.
Bibliography


Abstract
With advancing age a slowing down in performance is seemingly unavoidable. But it is generally accepted today that physical activity will in all likelihood delay the rate of aging and thus improve the quality of life.

In this study we have checked the benefits gained by exercising against resistance with the APT, in order to improve the walking speed of frail residents in retirement homes. Twenty-six such residents between the ages of seventy-six and ninety-three were examined. Their walking speed and their pulse rates were measured prior to a program of exercise consisting of twelve 10-15 minute lessons, and at its conclusion. Results showed an average improvement of 29% in the number of passive patients.

At the start of the program and at its conclusion a subjective evaluation was made in order to assess the degree of the patient's independence in daily tasks. The categories ranged from independence to total dependence. An increase of 127% in the number of independent patients was shown as well as a reduction of 29% in the number of passive patients.

We may conclude that exercise on the APT improves the mobility rate and therefore the degree of self-sufficiency in the performance of daily tasks.

Introduction
The ever-expanding geriatric population of the world calls for greater attention to the health requirements of the elderly. Older people must be made aware of the fact that increased life span and an enhanced quality of life are dependent on constant activity of both body and mind. It is undoubtedly easier to prevent disease than to treat it, and likewise indisputably cheaper. Therefore sustaining the ability of the elderly to function unaided is an issue of fundamental importance to public health.

Professionals trained in the treatment of the geriatric population are well aware of the direct relation between the mobility of the elderly and their general sense of well-being. Speed of walking is a reliable indicator of self-sufficiency and thus it may be assumed that exercise designed to improve walking and particularly its rate, will serve as a boost in functional performance.

The aim of this study was therefore to examine the improvement in walking speed after exercising on the active passive trainer (APT). Further objectives were to check the effects of APT exercising on:
1. The pulse rate at rest and after exertion; and
2. The level of daily performance.

Methods Used
Survey Location and Population
This study was done at the physical health institute of the Mish’an Retirement Home in Ramat Efal, during the months of January through May 1995.
Twenty-six elderly patients (three men and twenty-three women) ranging in age from 76 to 93, who had agreed to participate in the study, were examined. Six of them dropped out of various reasons.

All participants in the study suffered from difficulties in walking: 12 walked with the aid of a walker, five used a single cane, one used two canes, and two walked without any walking aids.

Data Collection
The study was carried out in three stages:
   a. A pre-test examination and collection of background data;
   b. 12 twice-weekly exercise sessions on the APT device;
   c. Post-test examination.
(Identical checks performed before and after the exercise sessions.)

Variables measured were:
   a. Speed of walking;
   b. Pulse rate at rest;
   c. Pulse rate immediately after walking;
   d. The patient's subjective appraisal of his own performance ability.

Results of Walking Speed and Pulse Rate
The results of measurements carried out on all patients before and after the study period.

<table>
<thead>
<tr>
<th>Patient</th>
<th>Age</th>
<th>Walking Aid</th>
<th>Walking Speed</th>
<th>Pulse Rate</th>
<th>Pulse Rate</th>
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</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Before</td>
<td>After</td>
<td>%</td>
</tr>
<tr>
<td>1</td>
<td>84</td>
<td>Walker</td>
<td>101</td>
<td>84</td>
<td>20</td>
</tr>
<tr>
<td>2</td>
<td>89</td>
<td>Walker</td>
<td>53</td>
<td>47</td>
<td>12</td>
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<tr>
<td>3</td>
<td>85</td>
<td>Walker</td>
<td>17</td>
<td>12</td>
<td>42</td>
</tr>
<tr>
<td>4</td>
<td>82</td>
<td>Walker</td>
<td>25</td>
<td>15</td>
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<td>13</td>
<td>11</td>
<td>18</td>
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<td>6</td>
<td>85</td>
<td>Walker</td>
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<td>81</td>
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<td>7</td>
<td>93</td>
<td>Walker</td>
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<td>11</td>
<td>64</td>
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<tr>
<td>8</td>
<td>84</td>
<td>Walker</td>
<td>48</td>
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<td>49</td>
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</tr>
<tr>
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<td>83</td>
<td>One cane</td>
<td>10</td>
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<td>15</td>
<td>86</td>
<td>One cane</td>
<td>12</td>
<td>9</td>
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<tr>
<td>16</td>
<td>73</td>
<td>One cane</td>
<td>31</td>
<td>18</td>
<td>72</td>
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<tr>
<td>17</td>
<td>78</td>
<td>One cane</td>
<td>38</td>
<td>29</td>
<td>31</td>
</tr>
<tr>
<td>18</td>
<td>87</td>
<td>Two canes</td>
<td>29</td>
<td>9</td>
<td>222</td>
</tr>
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<td>10</td>
<td>20</td>
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<td>20</td>
<td>76</td>
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<td>13</td>
<td>11</td>
<td>18</td>
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<td>Average</td>
<td>84</td>
<td></td>
<td>34</td>
<td>24</td>
<td>42</td>
</tr>
</tbody>
</table>
Effects of Exercise on the Walking speed:
The average walking time was reduced from 33.57 seconds before the exercise program to 24.14 seconds after the program, representing a 42% increase in the average walking speed.

Effects of Exercise on Resting Pulse Rate:
No change occurred in the resting pulse rate.

Effects of Exercise on the Pulse Rate after exertion:
The pulse examination immediately after walking the track showed that the average had decreased from 87.7 to 81.3 three quarter to the 20 patients that participated in the exercise program had a lower pulse rate after exertion.

Review of subjective estimate of daily function

<table>
<thead>
<tr>
<th>Mobility</th>
<th>Before Exercise Program</th>
<th>After Exercise Program</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Getting out of bed</td>
<td>-</td>
<td>4</td>
</tr>
<tr>
<td>Getting out of chair</td>
<td>4</td>
<td>7</td>
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<tr>
<td>Walking</td>
<td>-</td>
<td>2</td>
</tr>
<tr>
<td>Climbing Stairs</td>
<td>12</td>
<td>1</td>
</tr>
<tr>
<td>Climb an incline</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Leaving the ward</td>
<td>10</td>
<td>4</td>
</tr>
<tr>
<td><strong>Total Number</strong></td>
<td>25</td>
<td>18</td>
</tr>
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Daily Activities

<table>
<thead>
<tr>
<th>Daily Activities</th>
<th>Before Exercise Program</th>
<th>After Exercise Program</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Putting on socks</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>Putting on shoes</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td><strong>Total Number</strong></td>
<td>2</td>
<td>6</td>
</tr>
</tbody>
</table>

*Level of performance
1-dependent
2-partially dependent
3-partially independent
4-independent

Discussion and Conclusions
Aging is an integral part of life reached only by the lucky few. Studies dealing with the issue of old age show that physical activity by the elderly is the safest and most effective way to "age gracefully".

In this study we have shown that a program of exercise on the APT (exercise against resistance) considerably improves the walking rate in the elderly and frail. Furthermore there is an improvement in level of independence when performing daily activities.
4) Experience with Active Passive Trainer (APT)
Hiroshima University Medical Department,
Health Science Kotaro Kawaguchi, Japan.
May, 1996

Key Words
APT upper extremity ergometer VO2-Kgm correction

Introduction

For the exercise therapies of patients with some kind of disability of the lower extremities, the upper extremity ergometer are often used. Recently much research has been conducted for the exercise physiology with the upper extremity ergometers and this research is producing inconsistent results for the upper and lower extremity exercises.

Many of the upper extremity ergometers are quite expensive and require special skill to operate.

For this research we got the chance to use the upper extremity ergometer, which is light-weight, easy to operate and affordable. With this ergometer, we measured VO2 changes against the various loads and also measured the same with the bicycle ergometer.

Explanation of APT

APT (Active Passive Trainer, manufactured by Tzora Health Care Products) is compact and light weight (about 10 kgs) and quite portable. It can set the load with the combination of the number of the handle rotation (rpm) and the load levels. Five load levels are available.

The load setting procedure is easy, just pushing the buttons. By changing the handles to foot pedals, the exercise for the lower extremities can also be done, with the electric motor, the arms on the machine move automatically which allows the passive exercise to be done.

Research Method

Ten (10) healthy males, ages 24.4 +/- 3.7 and the weights 67.2 +/- 7.3 kgs, without cardiopulmonary disorder, participated in this research.

First, VO2 were measured with the bicycle ergometer. The load was set with 25w, 50w, 75w, 100w and 150w, with each load 2 minutes exercise was done. In-between each exercise, 3 minutes.

Second, VO2 were measured with APT. The participants set on the chair and the height of the arms was adjusted to the level of the shoulder. The participants gripped the arm handles with their arms almost straightly extended. The load was 6w, 12w, 24w, 72w and 144w.

2 minutes exercise was done for each load and after each exercise, 3 minutes rest was taken.
The result was presented on the graphs.

To get VO2 values, the aero monitor, AE280S from Minato Inc. was used. The average VO2 for the last 30 seconds of each 2 minutes exercise was designated as VO2 value for the respective exercise with the various loads.

Results and conclusions:

1. Peak VO2

<table>
<thead>
<tr>
<th>Type</th>
<th>VO2</th>
<th>ml/m</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bicycle ergometer</td>
<td>1,830</td>
<td>97.5</td>
</tr>
<tr>
<td>APT</td>
<td>1,482.5</td>
<td>179.6</td>
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</table>

p<0.05

2. VO2/load

See the graphic presentation below.

With regard to the VO2 comparison between one with the upper extremity ergometer and one with the lower extremity ergometer, ACSM reports that VO2 with the lower extremity ergometer will be about 1.5 times larger than VO2 with the upper extremity ergometer as the upper extremity ergometer requires the involvement of more muscle groups due to the fix of the upper body.

However, in Japan, there are many opposing researched - larger VO2 with the lower extremity ergometer, comparing the peak VO2, AT and Vt.

Our research resulted in the larger peak VO2 with the bicycle ergometer than one with APT. however, as you can see from the graph, up to 375 kgm (62.5W), VO2 values were larger with APT and from that 375 kgm point on, VO2 values were larger with the bicycle ergometer.

By continuing to take VO2 data with various patients, we would like to re-evaluate this graphic result.

APT, which we used for this research, is the excellent upper extremity ergometer for training, setting the load with the combination of 5 different load levels and the various rpm. The correlation between VO2 and the load was 0, 912 (r=0.912) with our research result and showed very high correlation.

We believe that the APT can be used as the evaluation equipment with the reference to the graphic presentation for VO2 data. So, we would like to prepare the similar VO2 data for female and elderly people.
5) Project for the Development of Programs for Sheltered Welfare Patients
The "Ruhama" Hostel, Kfar Sabah,
The Department for the Treatment of the Mentally Disabled
Ministry of Labor and Welfare

Developing programs for sheltered patients

This project is financed by the fund for the disability allowances of the Ministry of Labor and Welfare, under the supervision of the department for the diagnosis and advancement, headed by Dr. Haya Aminadav. The team conducting the project consists of Dr. Haya Aminadav, Ms. Zehava Dashdus (National Inspector of Nutrition), and Dr. Yoav Metrik, chief physician in the department for treatment of the mentally disabled.

The project team:
Sarah Eshed - Music therapist
Sharon Tishler - Occupational therapist
Freda Kornbrot - Communications clinician
Carmit Kahana - Physical therapist

The Ruhama Hostel in Kfar Saba

The hostel, established in 1940, was the first of its kind in Israel. 191 sheltered welfare inmates reside there today, with full board and lodging. The hostel is in the process of building and renewal, which will provide a wide range of facilities including living quarters and remedial treatment units.

The Project Population

20 patients aged 21-50, the majority of whom are confined to adapted wheelchairs, live in the "Lemon" nursing unit. Most are severely retarded and have a low level of performance. None of the patients are independently mobile and all require constant care and aid in their daily activities.

Project Aims:

- Diagnosis and determination of the performance potential of the "Lemon" nursing Unit patients.
- Assistance to mentally retarded patients in developing their potential capabilities and mobility skills.
- Introduction of remedial care into the daily life of the patients.
- Improvement of their quality of life.
- Enrichment of their daily routine.
- Multi-professional teamwork in conjunction with the unit caregivers.
- Location and introduction of advanced facilities and equipment for unit daily use.
Advantages in Use of the APT Device:

- Two-directional passive activation, adapted to the particular difficulties of the patient.
- Independent activation, as required by the therapy program and the daily routine of the patient.
- Adjustment of accessories, and individual support to each patient. Gradual withdrawal of support as the patient progresses and gains self-confidence in his actions.
- Raising and/or adjusting the speed of operation as required by the therapy.
- Functional improvement according to the personal program of each patient.
- Increased interest and performance in the daily activities of the patient.

Plan for APT Activation in the House

- Comprehensive diagnosis of the exact range of movement of each patient.
- Patient and staff familiarity with the device.
- Appropriate program of treatment for each patient.
- Convenient placing of device.
- Program for daily routine and regular remedial care.

Problems in operating the APT in the "Lemon" house:

- Helping patients to become familiar with the device took far longer than anticipated.
- Physical difficulties with lower limb use on patients confined to customized wheelchairs.
- The poor conditions of the "lemon" house.

Interim conclusions

Of the 20 patients in the house:

- Three did not commence treatment at all - two lay prone in wheelchairs, and reacted pathologically.
- Three train completely independently with the device.
- Three train with the device, alternating from side to side.
- Four train on both sides, but require constant support and accompaniment.
- Five require only minimal supervision and support.
- Three are treated lying down as well as sitting up.
6) Tracking the use of APT. Active / Passive Exercise machine: Sample group of army disabled
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Introduction

The APT. Active / Passive Exercise Machine is intended to activate the hands and feet. APT is made so that it can be used in an active manner (that it, the user trains his muscles against a defined force, like the operation of fitness machines), or in a passive manner (that is, the electronic system of the machine activates the user's hands and feet in a manner whose speed and range of motion are controlled). In addition, the machine may be operated in a combined manner - active/passive - in which the user uses the electronic system while activating his muscles. The APT may be used while either sitting or lying down.

The active/passive exercise machine was given to a group of 10 severely handicapped army disabled, who have functional problems in their hands and feet, resulting from damage to one of the vertebrae in the spine, or from injury to the head. Table 1 gives the details of the sample group. The machine was given to each disabled personally, after having received detailed instructions regarding its use. The machine was given for a period of three months. It was decided that during this time, the use each group member made of the machine would be tracked. The tracking was conducted via periodic telephone conversations, and listening to the subjective opinion of each user. In the telephone interviews, each user was asked to supply information regarding several topics:

- Duration of use in each exercise session
- Frequency of use
- Methods of use - active, passive or combined
- Levels of difficulty chosen by the user
- Physiological changes if there are any
- Critical comments
- General opinion

The aims of the tracking were:

- To locate mechanical problems and provide immediate answers to them
- To teach various means of using the machine
- To identify special needs
- To consolidate recommendations for continued development

The Sample Group

The sample group included 10 disabled with a high level of disability, who were selected randomly by the rehabilitation division of the ministry of defence. Below are the group's details:
Table 1: The Sample Group

<table>
<thead>
<tr>
<th>User's code</th>
<th>Year of birth</th>
<th>Injury type</th>
<th>Injury year</th>
<th>Date Machine Received</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1953</td>
<td>Head</td>
<td>1973</td>
<td>8.2.94</td>
<td>Partial paralysis</td>
</tr>
<tr>
<td>2</td>
<td>1961</td>
<td>Back, C6</td>
<td>1984</td>
<td>31.1.94</td>
<td>Partial paralysis, spasm</td>
</tr>
<tr>
<td>3</td>
<td>1953</td>
<td>Head</td>
<td>1980</td>
<td>31.1.94</td>
<td>Partial paralysis</td>
</tr>
<tr>
<td>4</td>
<td>1933</td>
<td>Back, C6</td>
<td>1954</td>
<td>1.2.94</td>
<td>Partial paralysis, spasm</td>
</tr>
<tr>
<td>5</td>
<td>1952</td>
<td>Back, D2-3</td>
<td>1972</td>
<td>31.1.94</td>
<td>Spasm</td>
</tr>
<tr>
<td>6</td>
<td>1973</td>
<td>Back, C5</td>
<td>1992</td>
<td>26.1.94</td>
<td>Partial paralysis, strong spasm</td>
</tr>
<tr>
<td>7</td>
<td>1960</td>
<td>Back, C5-6</td>
<td>1980</td>
<td>31.1.94</td>
<td>Spasm</td>
</tr>
<tr>
<td>8</td>
<td>1940</td>
<td>Back, L2</td>
<td>1960</td>
<td>26.1.94</td>
<td>Partial paralysis</td>
</tr>
<tr>
<td>9</td>
<td>1938</td>
<td>Back, L1</td>
<td>1962</td>
<td>11.2.94</td>
<td>Partial paralysis</td>
</tr>
<tr>
<td>10</td>
<td>1969</td>
<td>Back, C6-7</td>
<td>1991</td>
<td>15.2.94</td>
<td>Weak spasm</td>
</tr>
</tbody>
</table>

Characteristics of use

Table 2 shows the usage characteristics of each of the participants in the sample group. The table presents the user's code, the time of usage in each session, the frequency of use, separately for hands and feet. The meaning of the term "active" is that the user operates the machine using only his muscles. The meaning of the term "passive" is that the motor of the machine moves the user's hands or feet. The meaning of the term "combined" is that the user operates the machine using both the strength of his muscles and the motor of the machine.

<table>
<thead>
<tr>
<th>User's code</th>
<th>Hands</th>
<th>Feet</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Time</td>
<td>Frequency</td>
</tr>
<tr>
<td>1</td>
<td>15-20 mins</td>
<td>Everyday</td>
</tr>
<tr>
<td>2</td>
<td>25 mins</td>
<td>2-3 times a week</td>
</tr>
<tr>
<td>3</td>
<td>5 mins</td>
<td>Twice a week</td>
</tr>
<tr>
<td>4</td>
<td>10 mins</td>
<td>Twice a day</td>
</tr>
<tr>
<td>5</td>
<td>30 mins</td>
<td>1-2 times a day</td>
</tr>
<tr>
<td>6</td>
<td>10 mins</td>
<td>Almost every day</td>
</tr>
<tr>
<td>7</td>
<td>10-15 mins</td>
<td>1-2 times a week</td>
</tr>
<tr>
<td>8</td>
<td>10 mins</td>
<td>Almost every day</td>
</tr>
<tr>
<td>9</td>
<td>10-20 mins</td>
<td>3 times a week</td>
</tr>
<tr>
<td>10</td>
<td>20 mins</td>
<td>Everyday</td>
</tr>
</tbody>
</table>
Subjective evaluation

In this section, we will present some of the user's comments, as expressed by them during the telephone interview. The comments include the subjective opinion by the sample group members of the operation of the exercise machine, as well as suggestions for improvement. It must be noted that each of the group members expressed much satisfaction with the machine and its operation, and all them would like to have the machine remain at their disposal. The name of each speaker is not noted in this report, but exists on the interview sheets.

Positive comments:

"The machine is excellent".
"It relaxes the legs in a fantastic way"
"Overall greatly enjoying the product. The previous machine was primitive and this is at another level".
"Very comfortable to use".
"Very good for the blood flow to the legs".
"Simply wonderful".
"During a spasm, the machine stops working and changes direction and that relaxes the spasm".
"Satisfied with the machine".
"The frequency of use went up with time, from three times a week to everyday, and from 5 minutes of use to 10 minutes each time".
"Relaxes the shoulders well"
"The spasm relaxes after use"
"Feel better in the whole body"
"Great for the hands"
"The machine is light and can be moved from place to place"

Critical comments:

"Its good that the machine is light and portable, but it is not sufficiently attached to the ground"
"I want a head switch"
"Use it for the hands only because of inconvenience in lifting and lowering the machine"
"Even though the machine is relatively light, it is heavy for a woman. Would very much like a mechanism that would allow raising and lowering the machine for use with hands and feet"
"During use on the bed, the machine slides"
"The straps don't connect the machine well enough to the cart, and it slides".