post-polio syndrome, and we were unable to confirm the findings of the previous study.

Lastly, we might ask the question, "What can the study of poliovirus infections teach us in a very broad sense about post-polio syndrome?" One of my interests is to learn about factors key to the survival and death of the motor neuron itself. Remember the poliovirus is very selective. The virus only infects and kills motor nerve cells. We should remember that the living vaccine that is presently given to prevent polio is also a live poliovirus. It replicates in the human body, but it does not paralyze.

Other investigators have cloned and sequenced the parental paralytic strain and the Sabin vaccine strain of poliovirus as well as paralytic revertant mutants that rarely arise after vaccination and may cause poliomyelitis. We now know that the vaccine strain that Sabin developed has mutations that occurred during passage of the parental paralytic strain. Investigators can now "mix" the Sabin vaccine strain with the parental strain and make recombinants of the genes. Each of these recombinant genes can be made into a virus which can be tested to determine how paralytic it is. As a result of these experiments, we now know exactly what the key mutation is that makes the paralytic parental strain a non-virulent vaccine strain. In other words, the part of the genes of this virus, as well as viruses related to poliovirus, that causes paralysis or death of motor neurons has been identified. This knowledge is important in our understanding of which genes and gene products kill motor nerve cells and the mechanisms involved. In addition, these studies will be important in making the "perfect" poliovirus vaccine. We have very good vaccines, but as a result of this kind of work, we will be able to make changes in the genes so that the vaccine will "never" generate a revertant that can cause poliomyelitis.

* This article is a revised version of the transcribed and edited remarks published in Polio Network News (Vol. 5, No. 4).

FOR YOU TO CONSIDER

A HYDROTHERAPY PROGRAM FOR PATIENTS WITH POST-POLIO SYNDROME

By Lynette Jenkins, M.C.S.P., M.C.P.A., O.N.C., Toronto Rehabilitation Centre, Toronto, Ontario, Canada

Post-polio survivors referred to the Toronto Rehabilitation Centre from Dr. William Franks and other physicians in Toronto are assessed by the Centre's own physician, an occupational therapist, a social worker, and a physiotherapist.

THE POOL

The pool is approximately 30' by 18', with a "stepped" floor providing four depths, 2'6", 2'11", 3'5", 4'5". Access is either by shallow steps or by a mechanical hoist. The temperature of the water is kept at approximately 96 degrees Fahrenheit. The pool is equipped with "furniture," consisting of aluminum chairs and parallel bars.

The Hydrotherapy Program

Polio-affected muscles are weak and in some cases paralyzed. This can lead to a tightening or even a contracture of the affected tissue. Slow, gentle stretches, always within a pain-free range, help to alleviate this tension, reduce contractures, and relieve cramping. While it may be impossible to strengthen muscles affected by polio, it is possible to strengthen the unaffected muscle groups. Very often extra strain is exerted on them, and so strengthening routines can help prevent damage because of the overload.

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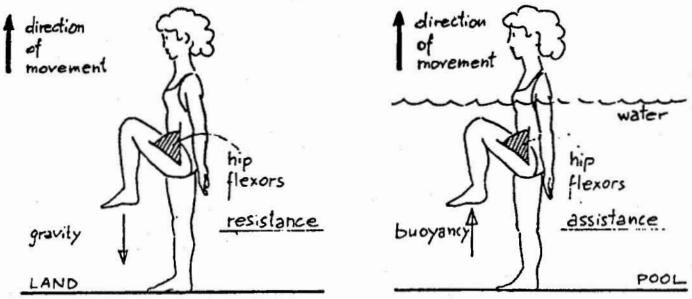
It is easy to work in the security and warmth of the water, and it may be possible to overwork. Survivors are constantly reminded to work within their own exercise tolerance level and to take frequent rest periods to ensure that muscles do not get overtired. Exercising the individual part at the expense of the whole body is constantly guarded against.

Postural corrections are taught, as inefficient posture can aggravate joint aches and pains. Body mechanics and activities of daily living are also discussed because an increase in body awareness leads to a decrease in body use.

On land people with polio often cannot raise their level of physical activity to bring about a rise in the heart and respiratory rate. It is possible to do this in the water, so quick repetitive, small-range movements are taught to help improve cardio-pulmonary efficiency. Pool sessions last for approximately half an hour, with two-thirds of the time being given to formal exercising and the remainder to "free" time.

It may be impossible for the person with polio-affected hip flexor muscle to stand on one leg and bend the other knee up to the chest on land. The muscle has to have a certain strength to produce movement to resist the downward pull of gravity. The effects of gravity are eliminated when that person is in a pool. The buoyancy of the water acts as an upthrust that actively assists the movement, making the action possible.



When the bent leg is brought down next to the standing leg, buoyancy may also be used as a resistance for exercising (Figure 2a). The hip extensors work against the buoyancy of the water making the exercise more difficult to perform.

Buoyancy, either as an assistance or resistance, determines the starting position. Available muscle strength also determines the starting position for every exercise. Sometimes buoyancy is just too efficient and webbing straps are used as seat belts to stop people from floating away when they are doing sitting exercises.

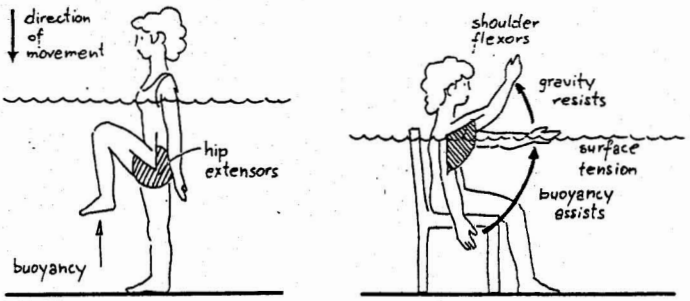
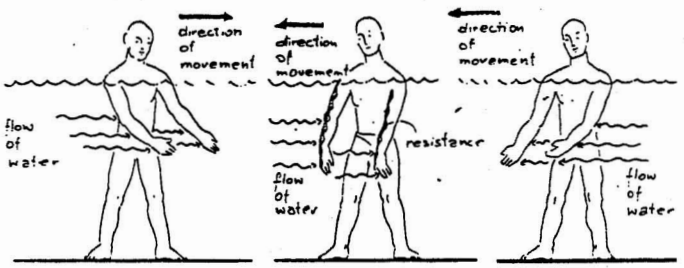


Figure 2a & 2b

Exercising under the water is easier than exercising out of it, but the water itself can also act as a resistance. At the point of change from water to air or air to water (Figure 2b), the surface tension of the water acts as an extra resistance to the movement. The speed of the exercises may be increased or decreased depending on the available muscle strength. The faster the exercise, the harder it becomes because the mass of the water now acts as a resistance. When performing an exercise that involves a change of direction, the turbulence of the water created by the initial movement acts as a resistance at the changeover position.



The various depths of water are needed not only because of the various heights of people, but also the deeper water exerts greater hydrostatic pressure on the limbs. This pressure, combined with the warmth of the water, aids the return of venous blood to the heart and helps prevent edema in the extremities.

THE PHYSICAL EFFECTS OF HYDROTHERAPY

The stretching routines help to increase flexibility, prevent contractures, and relieve cramping in all muscles. Strengthening exercises improve muscle tone, strength, and endurance. The duration and pace of the program helps raise the cardio-respiratory efficiency. An increase in body awareness, joint conservation, and postural control encourages a greater level of responsibility on the swimmer's part.

THE PSYCHOLOGICAL EFFECTS OF HYDROTHERAPY

The warmth and buoyancy of the water promotes a general reassuring environment. There is a freedom from restrictive braces, canes, crutches, and wheelchairs.

LONG-TERM MANAGEMENT

Follow-up exercises to be done in a bathtub are taught, but the lack of space is rather limiting. As we received more and more referrals from West Park, the original group of patients had to make way for the newcomers. The graduates formed the Post-Polio Penguins, with the motto "wobbling on land...waltzing in the water," and since discharge from the Centre have continued to meet as a group, using community pools for their exercise sessions.

Hydrotherapy is, of course, pleasurable for the patient. We can all attest to that. However, I should stress that I am speaking from my own experience. There are doubtless other centers which can claim equally good results from specially designed dry-land regimes. For those areas where therapeutic pools are not available, therapist and institutions must devise and apply other forms of assistive exercise programs to help control the potentially progressive problems of post-polio.

THE POST-POLIO PENGUINS

By Dorothy Gowen, Scarborough, Ontario, Canada

The Post-Polio Penguins is a self-help group which evolved from a handful of people meeting twice a week for water therapy at the Toronto Rehabilitation Centre. We were given an hour each week following our pool time to assemble, together with our physiotherapist, to discuss mutual experiences, problems, and possible solutions for them. During these sessions we would often discover that one or more members of our group had coped with a similar situation to the one being discussed. Many times these problems were resolved. When they were not, the person facing them had the positive support and caring of a concerned group. We also gained a more healthy approach to admitting that we had weaknesses. Some of us had been loath to share our problems with family members, thinking it unfair to burden the family; but through this group we learned to share the knowledge we had gained.

The group has given many of us the determination and the courage to say to others that we are no longer able to do certain things. We no longer place ourselves in the harmful position of having to say "Yes" to every request. In fact, if our group hears of a member attempting to do something rash or too tiring, we do not hesitate to butt in and advise that person against it.

We are learning to take charge of our own lives. We make decisions that are good for us. We have gained enough confidence in our

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worth to recognize that it is not selfish to do this.

When we had to leave Rehab to allow room for other post-polio clients to use the pool, we felt the need to function as a group, so we organized ourselves into the Post-Polio Penguins. Our express goals are to support each other and to find suitable therapy pools to continue our beneficial exercise and recreation program as a group. Post-polio people do not necessarily feel the benefit of hot water therapy, nor are they interested in locating suitable pools. The Penguins belong to the larger group of Toronto/Peel Post-Polio Chapter under the March of Dimes, and we applaud and support its efforts; nevertheless, we feel the need to retain a separate identity. We are a much smaller group and have the opportunity to become closer to one another. This results in closer communication, better knowledge of each other, and a very caring colony of Penguins.

We have made an observation we should like to pass on to others--the happiest Penguins are the ones who are ready to accept change and adopt a new life-style. We are all trying to learn to "go with the 'floe.'"

FOR YOU TO CONSIDER

Sandra Hughes Grinnell, B.A., graduated from the University of California, Santa Barbara, with a major in Sociology and a minor in psychology with emphasis on behavior modification. She and her husband, an environmental specialist, have lived in Southern California for the past 15 years. The following article is available in its entirety from IPN for $2.50 (photocopying and postage). The first part was printed in the Fall Polio Network News (Vol. 5, No. 4).

A Post-Polio "Normal's" Reconciliation with the Ghost of Polio Past - Part II

By Sandra Hughes Grinnell, Independent Medical Researcher, Pasadena, CA

I had muscle strength tests done in areas never evaluated since the onset of polio in 1953. There was a large variation in muscle strength in the trapezius muscles (located in the upper back) as follows: upper trapezius muscles left and right, good; middle trapezius left and right, fair plus; and lower trapezius left and right, poor. I asked the therapist if that major drop from good to poor could account for the incapacitating attacks of pain and fatigue I had experienced for many years in that area and represent a residual loss of muscle strength directly related to "old polio." He answered with an emphatic "Yes, absolutely" to both questions. It was the first "yes" I had heard from the medical profession with regard to questions making a connection to my polio experience since a doctor said to my parents in 1953, "Yes, your daughter has polio." Now, in 1984, the "yes" was actually comforting to hear, because it put some logical perspective on my present situation.

Also, I learned during the trapezius muscle tests that I was not lifting myself up from a lying position with any significant upper body assistance. I was going through the motions with the arms and hands and it appeared as though I was lifting myself up, but I learned that in reality I was substituting muscles and lurching into a sitting position using my low back and abdominal muscles. In hindsight, I realize that since I had graduated from college I had gained 25 pounds, and my abdominal muscles were not as strong as they used to be. It is true that with the exception of shortened hamstrings, my lower extremities were