THE EFFECT OF LOW FREQUENCY SOUND AND MUSIC ON MUSCLE TONE AND CIRCULATION

by Anthony Wigram and Lynn Weekes

This paper traces the early development of the use of low frequency sound and music as a treatment procedure. It describes some of the initial work undertaken in Norway, Finland and England, and gives examples of specific physical disorders and disabilities that this treatment process has been influential in treating. It examines some of the anecdotal evidence already recorded in the treatment of muscular disorders and circulatory problems, and also describes in detail some objective research that was undertaken in England, which looked at the effect of low frequency sound on spastic muscles and in less detail at some research that was undertaken in Estonia on neurotic clients.

The use of sound and sound technology as a treatment procedure is not a new concept, and history has shown evidence in both past civilisations and in different cultures of the use of sound to treat physical disabilities and pain. There have been many exciting developments in the latter part of this century in the use of sound for treatment, which have included for example the treatment of certain conditions by means of ultra sound (Forster and Palastange 1985) and interferential therapy (Savage 1984), a form of low frequency electrical stimulus. Other forms of electro-theraoy also include short wave diathermy, faradism, infra-red, ultraviolet light and most of these are applied to a specific area for a purely localised effect. The development of Music Therapy as a treatment has grown up in most countries as an interactional medium between therapist and client. Music facilitates a relationship-building process, often at an almost psychotherapeutic level, whereby the intellectual and emotional effect of music is significant in the therapeutic process.

Some consideration has been given to evaluating the significant and frequently measurable physiological response of sound waves on the human body. Dr. Benenzon describes such effects in his book (*Music Therapy Manual*, 1982) whereby muscular energy will increase or decrease depending on the rhythm, and there will be changes in the rate of respiration, and increased or reduced fatigue or voluntary activity. He also noted effects on heart rate, blood pressure and the endocrine function resulting in changes in metabolism. The study of the effect of sound on man has, in latter years, more naturally concentrated on the detrimental effects of excessive exposure to high-intensity sound, or to noise pollution. This paper is concerned in looking at the beneficial effects of a limited range of frequencies, commonly termed 'infrasound'.

The Norwegian therapist and educator, Olav Skille, first looked into the influence of sinusoidal, low-frequency, rhythmical sound pressure waves between 40/80 hz mixed with music in the early Eighties. The mode of treatment that Skille devised involved lying clients on top of loudspeakers which were built into a specially con-

structed unit, and transferring the frequencies produced directly into the body of the client. Skille initially described his treatment as a "music bath", a slightly colourful and imaginative term which in fact well describes the experience of being "bathed in sound". Subsequently he called this Vibro-Acoustic Therapy (VAT) and presented his first paper on this procedure to a symposium in 1982 of the International Society for Music in Medicine. Skille designed several test units which were subsequently used in Norway, and this process further extended to Finland and Estonia. I first encountered this process of treatment at the World Congress of Music Therapy in Genova, Italy, and subsequently constructed equipment in England for both treatment and research purposes.

All those involved in this early research have found similar results. Firstly, it is important to note that in many of the subjects who have experienced this treatment, the receptivity of the body to different frequencies, and the experience of feeling those frequencies in specific areas of the body was consistently similar in all subjects. It is found that 30/40 hz is felt in ankles and calves, 40/50 hz is felt in knees, thighs and lower abdomen, 50/60 hz is felt in the lumbar and thoracic areas, and 60/75 hz is felt in the neck and head.

On its own, listening to low-frequency sound is not a very satisfying experience. Consequently a pulsed tone is produced by combining two tones close together, the difference between the two tones determining the speed of the pulse. This is then recorded onto a tape with improvised or "new age", or repertoire music. The frequency of the low tone has to be harmonically compatible with the chosen music. The two elements of the treatment are therefore the vibration of the low sound, which treats the body and the music which treats the soul and satisfies the intellectual and emotional needs.

In March 1987, an international symposium for people involved in this work was held in Norway. The symposium was held to collect the experiences of users who had up to five years experience with the equipment and method, and during the symposium more than 10,000 hours of experimental treatment were placed on record. A great variety of work was described at this forum, including the effect of this treatment on multipally handicapped and mentally retarded clients of different ages, patients with pulmonary disorders, patients with rheumatoid conditions and people with muscular disorders. In Norway, work concentrated particularly on the benefit of treating people with muscle spasm, pain or pulmonary conditions. Low frequency sound waves were found to have a spasmolytic effect on muscle tissue. The effect has been used in the treatment of children with cerebral palsy at the Health Centre at Sonjatun, and also at the Head Injuries Unit at Sunnas Hospital to reduce muscle spasm. Users of vibro acoustic therapy consistently report relief of pain. A Chief Community Nurse at Kafjord has treated patients with rheumatism, and reports a decrease in pain. Therapists treating sport injuries have also found this therapy to be useful in relieving pain. In Over-use Syndromes, vibro acoustic therapy is reported to relieve pain and reduce the length of the rehabilitation period.

It has also been noted many times that people fall asleep while receiving vibro acoustic therapy, and this effect has been used by staff at the centre in Steinkjer to treat insomnia. Patients report that after vibro acoustic therapy they find it easier to fall asleep at normal times and also that the duration of sleep is longer than they usually experience. Finally, the gentle vibratory effect of low-frequency sound waves on pulmonary tissue has been found to loosen lung secretions, thus affording better gaseous exchange in patients with cystic fibrosis, bronchiectasis and chest infections.

Since constructing the equipment for treatment and research in England, during 1988 over forty clients at Harperbury Hospital had regular sessions of vibro acoustic therapy. These sessions were started primarily as treatment sessions and although notes were taken of the effects, these were not clinical trials. However, some very interesting results came out of this work which highlighted the value of this therapy for a variety of different conditions. One elderly lady who was treated is severely spastic with a kyphosis and a scoliosis. She has extensive spasm of her hips, one elbow, some of her fingers and her tongue, which makes speaking very difficult. She has flexor spasms of her trunk, one arm and most of her fingers. She has some very painful joints and also suffers from asthma. She had vibro acoustic therapy twice a week for two years, and she relaxes to the extent that she very often falls asleep during treatment. She is a frail, thin, intelligent lady with a very keen sense of humour. When her tongue thrust is relaxed, she is able to talk more clearly. At the beginning of the treatment session, she will be extremely spastic with distressed, rasping breathing. By the end of thirty minutes, she will often be breathing peacefully and drifting off to sleep.

Another client we worked with is a 31 year old athetoid man who besides involuntary movement, also has severe right side spasm, frequent atonic neck reflex, and extensor spasm. Much of his struggle to undertake simple tasks is hampered by these additional disorders. In addition, he has chronic constipation and needs an enema every eight to ten days in order to move his bowels. After the vibro acoustic sessions, his muscle spasm had reduced with fewer fluctuations in muscle tone, so that he was able to control his movements better. We also found that the days he had a treatment (or the day after) he wanted to move his bowels.

In looking at the deeply penetrating effect of low frequency sound waves as an effective means of improving circulation, we also worked with a client who had chronic oedema. His oedema was so severe in both legs that from the point below his patella down to his toes, his skin was stretched and shiny and the tissue fluid had organised i.e. the legs felt very hard. His legs were swollen, and he frequently had sores and the condition caused him serious discomfort. He enjoyed the treatment sessions and in using a frequency of around 40 hz, we measured the circumference of his ankles before and after the treatment. Typically, we found a reduction of between 1/2 inch and 1 inch in size over the course of a half-hour treatment.

Much of this evidence supported the increasing body of evidence found in Norway and Finland that vibro acoustic therapy was proving successful in a variety of situations. Research work has now been undertaken to look at the value of this ther-

apy. In Norway, pilot studies have been undertaken on patients with asthma, bronchial, fibromyalgia and functional dysmenhorrea.

In Finland, an independent group's design was used to evaluate the effect of vibro acoustic therapy on occupational stress in an insurance company. Thirty-two subjects were divided into two groups, one group getting traditional stress reduction treatment, i.e. autogenic training, processual insight etc. and the other group getting vibro acoustic therapy. Measures that were used were normal physical examination, psychiatric interview, the Spielberger Scale, and stress hormone analysis (adrenalin, nor-adrenalin and cortisol). They found quite a difference between the two groups. For example, 54% in Group 1 had a reduced stress level, compared with 80% in Group 2. On the Hamilton Anxiety Scale, 62% reported decreased anxiety in Group 1 compared with 87% in Group 2. Although the number of subjects was too small to give a statistical significance to the result, the result is good enough to give a strong indication that progress was made in both groups and that in all three tests Group 2 obtained better results than Group 1.

In Estonia, a psychiatric research team looked at the effect on forty neurotic patients. They measured the results by psychological test and by blood pressure measurement. They treated 25 subjects from different areas of society with a variety of disorders including depression, hypochondria and hypertension. The Estonian research team found that firstly, the treatment of elderly patients was more effective. They also found that women are more easily cured than men (they became less tired, had less headaches, were less distressed and had less trembling of their hands). In terms of its effect on the autonomic system they found that blood circulation was improved. Acro-cyanosis was diminished and the temperature of limbs rose. Systolic and diastolic blood pressure drop, headaches and nausea vanish and there was an improvement in cerebral blood circulation. They summarised the effect of their treatment as follows: a rise of self confidence, less stomach troubles, less headaches, less depression and they felt that the therapy can play a considerable part in the treatment of neurotic patients and patients with hypertension.

The research we have been engaged with looks at the use of this treatment to reduce muscle tone in spastic patients. We designed a research project that set out to differentiate between the effect of music alone compared with music combined with low frequency sound. One might expect a reasonable degree of relaxation and reduction in muscle tone simply as a result of lying on a comfortable unit and having gentle music played, therefore we asked ourselves the question as to whether low frequency sound combined with music would have a greater effect than music alone. This research project was set up as a within subjects/repeated measures design, and ten subjects undertook a minimum of twelve trials each, six in each condition. Condition A of the treatment was when the subject had a thirty minute session on the vibro acoustic units and received music and low frequency sound. Condition B was when the subject received music alone, also for thirty minutes. The trials were carried out twice a week over a period of six weeks, and in order to control for order effects, subjects were not all treated on the same days of the week and the course of the trials for each subject was randomly determined. All vari-

ables, including the music, were kept constant in both conditions except for low frequency sound.

What we were actually trying to measure was whether we were able to reduce muscle tone in our clients. All our subjects for these experiments were cerebral palsied and had the spasticity as a result of high muscle tone. Independent evaluators measured the range of movement of the subjects before and after the trials, and blood pressure and heart rate measurements were all also taken. When the evaluator had measured the subject, they left while the treatment was carried out. At the end of a session, the evaluator would return and remeasure the clients without knowing whether or not the clients had received low frequency sound. Various points on the body were used for the measurements, including, for example, left shoulder to left wrist, right shoulder to right wrist, base of right patella to base of left patella to measure range of abduction, and the greater trochanter to the lateral malleolus of both legs to measure flexion and extension.

The results we obtained showed clearly in all of our subjects that when low frequency sound is combined with music one can expect a greater range of movement, indicating a reduction in muscle tone than when music is used on its own.

Of particular value for us was the results with certain subjects in certain measurements. For example, Subject 9 has severe adductor spasm, and the ninth measurement we took from her, the one where she had a 31% improvement in her range of movement when we used low frequency sound, indicated that abduction was much easier after this treatment, thus lessening the danger of a fixed deformity which may well lead on to dislocation of the hip. This treatment was therefore welcomed both from a long-term preventative point of view and a short-term treatment one.

We ran trials at the same time on subjects who had chronic oedema, and although the results showed a reduction, it was not at a significant level, and we decided that it would be necessary to treat the clients on a daily basis. When we monitored blood pressure, we discovered that our clients were not typical of the population at large. However, in the group we treated, we found that we had a significant result in reduction of systolic blood pressure after vibro acoustic therapy.

In conclusion, these were objective, blind trials and gave a very positive result in favour of the use of low frequency sound reduced muscle tone. The evidence from them was sufficient to support further research, and current trials involved the use of surface electromyography and skin conductance (electrodermal activity) as a means of measuring reaction of the autonomic nervous system. These psychophysiological measures will evaluate the effect of the activity of the muscles, and also the level of arousal of individuals. In addition, a mood adjective check list can be used before and after the treatments to evaluate the emotional and psychological effect on subjects. We are also interested in exploring the cumulative and long-term effect of this treatment, as indications from current treatment results suggest that it is not only effective immediately after the treatment, but also for several hours thereafter.

In conclusion therefore, one might comment that besides the very obvious benefits of this treatment for a variety of different disorders, one of the most valuable parts

of this treatment is that it is extremely pleasurable for the patients who have it. For example, maintaining the range of movement and preventing the onset of fixed deformities in spastic clients has to date often required strenuous and occasionally uncomfortable physical treatment, whereas we find that we are achieving very good results simply by lying clients on a special unit and giving them vibro acoustic treatment. It is a deeply penetrating, and relaxing sound which sets up vibration right inside the body. Using the correct frequency, and an appropriate level of intensity, and also combining with relaxing, unstimulating music, the benefits to a variety of different disorders is evident. The treatment does not claim to cure chronic or long-term illness, but it provides considerable relief from pain and discomfort.

Statistical analysis of the data supporting this conclusion may be obtained from the authors.

THE EFFICACY OF MUSIC THERAPY FOR PEOPLE WITH H.I.V. AND A.I.D.S.

by Colin Lee

London Lighthouse

London Lighthouse is Britain's first major residential and support centre for people living with H.I.V., A.R.C. and A.I.D.S.. It provides about ten holistic disciplines to help clients develop according to their needs. It is a centre committed to becoming an Equal Opportunities organisation which opposes all forms of discrimination faced by people with H.I.V., A.R.C, A.I.D.S., black people, women, drug-users, lesbians, gay men and people with disabilities. Its non-judgemental approach allows me, as music therapist, to explore deeply the use of creative intervention as a means of alleviating many of the psychological and physical problems associated with H.I.V. and A.I.D.S.

The foundation for Music Therapy at London Lighthouse is based mainly on therapeutic improvisation. I use this in individual sessions, group sessions and sessions for the residential unit. I have also come to acknowledge other forms of music which may have a positive therapeutic effect - for example, Guided Imagery, taped music, singing, concerts and piano teaching. Learning a new skill can give an individual an invaluable sense of achievement which has therapeutic consequences. This achievement helps the client in other areas of learning and supports his ability to live with the virus.

Two Case Studies - Charles and Colin

Charles was depressed and ill when he first approached Lighthouse. He had lost his managerial position in a large corporation; he had lost his car and was facing the potential loss of his property. Charles enrolled for Music Therapy, Arts Ther-