Vibroacoustic Therapy: The Therapeutic Effect of Low Frequency Sound on Specific Physical Disorders and Disabilities

Olav Skille, Tony Wigram and Lyn Weekes

Abstract

This article traces the early development of vibroacoustic therapy, and some of the theoretical basis for its use in a treatment procedure. It describes some of the initial work in the Scandinavian countries, gives examples of the type of problems that low frequency sound and music have been particularly effective in treating, and puts into perspective the use of music and sound as a physically effective means of treating people in comparison with the interactive forms of intervention commonly used by music therapists.

Much of the case material described in the article (Norwegian and English) is anecdotal. In the latter section of this paper, current research is described.

Introduction

There have been many exciting developments in the last two decades in the use of sound and sound technology in treatment techniques. Although this is not a new concept, and history has thrown up evidence both in past civilisations and in different cultures in the use of sound as a means of treating physical disabilities and pain, it is only in the latter part of this century that developments have occurred resulting in the use of such treatments as Ultrasound (Forster & Palastange 1985) and interferential therapy (Savage 1984), a form of low frequency electrical stimulus. At the same time that these developments were occurring, the growth of music therapy as a form of treatment mainly concentrated on the use of music and improvisation in interactional work with people with communication disabilities. It has been by the building of a relationship through music by means of musical interaction that music therapists have been able to demonstrate breakthroughs in achieving both physical, emotional and cognitive response from people who had seemed inaccessible to other forms of intervention. This was evident in the work of Juliette Alvin (1975, 1976, 1978), and Nordoff & Robbins (1971, 1977) with handicapped children and adults, and subsequently by many music therapists trained in these approaches in England, in South and North America, Europe, Canada and Australia; although the approaches differ in terms of the means of developing interaction with clients through music, the ethos that music therapy is a process involving the perceptual cognitive and intellectual response of individuals to music is common. However, it has also been realised that whereas music achieves an intellectual response when listened to, music and sound also cause a significant and frequently measurable physical response when sound waves enter the body. The appreciation of music, and the emotional impact of a particular piece may also stimulate a physical reaction — it may be one of elation or depression, sadness or happiness. The components of a sound or combination of sounds, in particular their pitch, volume and timbre will have a significant physiological and biochemical effect on the body. Muscular energy will increase or decrease depending on the rhythm, and breathing will accelerate or change its regularity. Fatigue can be reduced or induced and voluntary activity may be increased. In addition, a marked variable effect on heart rate, blood pressure and the endocrine function is produced, and changes in metabolism and the biosynthesis of various enzymatic processes may be induced. These and further physiological reactions to sound and music were investigated and summarised by Dr. Benenzon, a music therapist and psychiatrist working in Argentina (Music Therapy Manual 1981).

In considering the effect of music and the elements that constitute music, and in fully understanding the processes involved in music therapy, the physiological effect of sound on the body should be taken into consideration. Juliette Alvin once pointed out that she had to learn about the physiological effect of sound, and she commented that although most music therapists consider the emotional and psychological responses, the physiological reaction to sound is just as significant and often ignored. Therefore, as sound can be seen to have a significant effect both biologically and physically, further investigation has been carried out as to how sinusoidal tones can be used in a treatment process. Physical problems presenting to a music therapist working with cerebral palsy clients will often include flexor

or extensor muscle spasm: the dichotomy in a treatment process involving interactional work is that whereas one can see a development in the responsiveness of the individual to the therapist, the increased level of activity will often stimulate a spasm. Looking at ways of reducing the high muscle tone created by this spasm, there is a considerable body of evidence on the effect of mechanical vibration (Stilman 1970, Carrington 1980) where a motor within an object or on a base unit will set up a physical vibration that is indiscriminate in terms of frequency. In the early 1980s, work began to look at the effects of low frequency sound on high muscle tone and spasticity. The idea of using a pure sinusoidal tone at a low frequency has been known for thousands of years, and in primitive cultures instruments and sounds were used to treat psychosomatic disorders. (In Shamanistic music, physical vibrations were often used). With more specific problems in mind, the possibility arose of finding a specific range of frequencies that could be coupled with relaxing, unrhythmic music to produce an effect directly into the body of physically handicapped people (Skille 1982, 1982, 1985).

The first attempts in using vibroacoustic therapy were conducted in Norway in 1980. The method was then tentatively named the 'Music bath' and 'low frequency sound massage'. The music bath is trying to create an environment whereby the body is 'bathed' in sound and vibration. During 1981/2, several test units were built in Norway, where there are thirty units at present in daily use. Further developments have led to research projects in Finland, England, Germany and Estonia. The process of vibroacoustic therapy was described at the first International Symposium for Music in Medicine in Lüdenscheid in 1982. The equipment (patented on a worldwide basis) consists of a bed/bench or chair with four to six built-in loud speakers. This is connected to a signal unit with six channels containing a cassette player which can run various tapes.

The process of vibroacoustic therapy involves lying a client on the bed so that the sound is being transferred by air directly to the body of the client. Sound may also be transferred through a mattress or some other means which can conduct the soundwaves directly to the body. The body vibrates according to the different soundwaves, and at 100 hz, 2% of the energy is absorbed by the client (Broner 1978). As one might expect, the soundwaves also have a substantial effect on the autonomic system.

The bed seems to have much in common with the instruments used by Pontvik and Teirich in the late '50s. Teirich cites Katz and Relesz as describing the sensations when listening to music is replaced by vibrations: 'one becomes conscious of a remarkable change of attitude, a change from within. While a musical tone is always subject to localisation in the room, the vibration sensation is localised in the body. One could say that the tones are pulled into the inner self, and they become closer to the physical I'.

Alongside the development of the music bed, it was necessary to develop taped programmes that would be varied and effective in treating different problems. Cassette tapes were made up with a mixture of music and rhythmical pressure waves which are in harmonic relation to the music. A pulsed tone is created by placing two tones very close together, i.e. 40 Hz and 40.5 Hz and this rhythmical pressure wave expects to cause a synchronisation of nervous impulses through the body, including the central nervous system. This comprehensive stimulation contribues to a harmonisation of a body which has come out of phase with itself because of defects or traumas caused by external or internal conditions. This process is influential in treating a number of disorders and handicaps, and this paper describes its therapeutic benefit. The music used is recorded over a pulsed, low frequency tone, and is invariably gentle, improvised and without a pronounced rhythm. Music has been written specifically for this therapeutic process, e.g. an improvisation on the tone E by the Finnish composer, Otto Romanovski. In addition, existing 'New Age' music by composers such as Don Campbell and Steven Halpern has been used. As far as the use of specific tones is concerned, subjective tests have indicated that the most significant frequencies range between 40 and 80 Hz. The lower frequencies, 40 to 55 Hz. will predominantly set up a resonant response in the lower lumbar region, pelvis, thighs and legs. As one moves through the frequency range so the sound is resonated in the more dense tissues of the body in the upper chest, neck and head.

In March 1987, the first International Symposium for Vibroacoustics was held in Norway. The Symposium was held to collect the experiences of users who had had up to five years of experience with the equipment and method, and during the symposium more than 10,000 hours of use were placed on record. Most of the recorded use came from the work with multiply

handicapped and mentally retarded clients of various ages. The reports were very positive, and identified the effectiveness of vibroacoustic therapy with a variety of problems ranging from rheumatoid conditions and muscle related problems to pulmonary disorders (Skille 1987, Wigram & Weekes '87). Reports were made at this symposium by a variety of professional staff who had been using the equipment including music therapists, physiotherapists, nurses and teachers. They have been working within the parameters defined by Skille in earlier papers, and in the initial work Skille had done to define frequency areas which have the best influence on specific conditions or ailments as specified in the Manual of Vibroacoustics (1986). Since the symposium, further work has been undertaken, specifically looking at the effectiveness of vibroacoustic therapy in many different areas and pulmonary conditions.

In Norway, work was concentrated particularly on the benefit of treating people with muscle spasm, pain or pulmonary conditions. Low frequency sound waves have been found to have a spasmolytic effect on muscle tissue. This effect has been used in the treatment of children with cerebral palsy at the Health Centre in Sonjatun and with the pre-school group at Fagerheim School; also at Moan School and Day Centre, Norway. Similarly, it has been used to reduce muscle spasm in patients at Lebenschilfe in Berlin, Germany and Harperbury Hospital, England. Bjerkely School has used vibroacoustic therapy with their multiply handicapped spastic children since 1985 with good spasmolytic effect, as has Österbo Central Institution since 1982. The head injuries unit at Sunnaß Hospital has been using vibroacoustic therapy to reduce muscle spasm in their patients since September, 1986.

Users of vibroacoustic therapy consistently report relief of pain. A chief community nurse at Kafjord has treated patients with rheumatism and at Sonjatun Health Centre, patients with polyarthritis and Morbus Bechterwe have been treated since October 1986. All report decrease in pain. In conditions which have an acute phase followed by periods of remission, e.g. rheumatoid arthritis, Morbus Bechterwe, use of low frequency sound waves in the acute stage may cause an increase in pain. It should, therefore be given in the non-inflammatory period and avoided in the acute stage.

Moan School and Day Centre reported relief of stomach and colic pain. Österbo Central Institution reports relief of both muscular and menstrual pain. Therapists treating sports injuries have found vibroacoustic therapy a useful method of relieving pain. In over-use syndromes low frequency sound waves are reported to relieve pain and reduce the length of the rehabilitation period. When treating injuries it is at present advised that vibroacoustic therapy should not be used where there is any internal or external bleeding. It has been noted many times, that people fall asleep while receiving vibroacoustic therapy and this effect has been used by staff at Trilax Centre, Steinkjer to treat insomnia. Patients report that after vibroacoustic therapy they find it easier to fall asleep at normal times and also that the duration of sleep is longer than they usually experience. 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. The Österbo Central Institution considered whether the reductions they had noticed in minor chest infections in clients who were on a VAT programme was attributable to the treatment.

Following the symposium in 1987, an experimental programme in the use of vibroacoustic therapy was set up in the Mental Handicap Unit of the North West Herts District Health Authority, in England. In collaboration with the Physiotherapy Department, the Music Therapy Department designed and built equipment which was used subsequently with clients who had high muscle tone and spasm. The existing programmes had been developed using a combination of music and movement (Wigram and Weekes 1984), where an effective way had been found to treat cerebral palsy clients who had deteriorating problems due to flexor or extensor muscle spasm. It seemed that the value of vibroacoustic therapy could be in reducing muscle tone to the extent where the maximum possible range of motion could be maintained and the onset of fixed deformities would be delayed still further.

There was additional anecdotal evidence from the work to date in Norway of the effects of low frequency sound in improving circulation. It was therefore decided to look more closely at another chronic condition in long-stay elderly residents, oedema in the lower limbs.

During the course of carrying out over 380 treatments from January to December 1988, Wigram and Weekes found comparable results to the work to date in Norway. With one client, there

was a specific reduction in muscle spasm in the back, arm, trunk and legs. After the treatment sessions, the patient initiated spontaneous movement and after three treatments her respiration had improved and she was laughing during treatment. Another patient, with very severe spasticity, showed a general reduction in her muscle spasm, and the worried frowning expression on her face disappeared during the sessions. Her shoulders are much more relaxed and her chest movements have increased. Again the patient started spontaneous movements with her arms as a result of the reduction in muscle spasm. She also began vocalising in the sessions, and the extent of her relaxation is that she accommodates to the flat surface on which she is lying and rests her head for long periods of time. She began to flex and extend her legs where previously they were locked in spasm. A third patient also had gross physical deformities, and a worried frown on her face because she was very anxious about being moved. She had been considered for a possible operation to release the soft tissues in her legs which are at present crossed due to her adductor spasm. During the course of the treatment, there has again been a general reduction in the muscle spasm with this patient. She has gross scoliosis and had rapid, distressed breathing, which became easier during the course of treatment.

A final example of the client group treated during the course of 1988 was an ataxic lady with typical increased lumbar-lordosis and rigidity of her spine, who also has arthritic changes in the spine and knees. She was treated with a pillow under her head and under her knees in an attempt to make her comfortable on the vibro unit. After 10 minutes of vibroacoustic therapy she was smiling, and when she came for the second treatment she was very keen to go on the unit and smiled throughout the session. She was treated in the early morning, and at 6 p.m. in the evening she was still pain free. She coughed during her treatment due to the vibration loosening secretions and eliciting the cough reflex.

In looking at the effect of low frequency sound on rheumatism and rheumatoid arthritis, a lady was seen who had very painful joints, and whose hands were in splints. It was very difficult to seat her comfortably as she was apprehensive about being lifted on to the vibro unit. She was made as comfortable as possible using several pillows filled with polystyrene beads, and after ten minutes treatment she said she was feeling much more relaxed. After twenty minutes, her shoulders had relaxed and she was able to touch her own nose and was smiling. After three treatments it was easier to put her back in her chair because it was possible to bend her hips to 90° and she was altogether more comfortable.

As a result of treating residents in the Hospital, the unit evoked interest in staff. One physiotherapist had a back problem with sciatic nerve complications and was off work for five months having tried various forms of treatment. She is now better but left with minor pains in the sciatic area. There was a significant improvement in the mobility of her back, and most important of all, she had a substantial reduction in pain. Another member of staff had a history of Sacro-iliac strain. She is frequently required to undertake heavy lifting in the unit and had recently suffered an acute spell of pain. The sessions she had on the vibro unit gave her considerable relief, and she is now more mobile and pain free. There are other examples of minor problems such as neck strain, headaches, and small back pains that were alleviated with the vibro unit.

Methods of evaluating and recording the effectiveness of vibroacoustic therapy have, to date, relied largely on subjective record and a considerable body of anecdotal evidence. Depending on the conditions being treated, more objective measures are now being used to give a reliable and valid measure of the short and long term effects of this therapy. Research projects are running in Norway, Finland, Estonia and England. Projects in Finland have looked at the value of vibroacoustic therapy as a means of reducing stress (Lehikoinen 1987). A research programme has recently been concluded by Wigram and Weekes in England looking at the reduction of muscle tone in cerebral palsy clients, and a single-blind test was used to evaluate. Two separate frequencies were used of 40 Hz and 44 Hz and treatments were carried out twice a week on twelve clients. Measurements were taken before and after treatment sessions by independent evaluators to monitor the range of movement in a variety of joints. The experiment was primarily concerned with monitoring the influence of low frequency sound, and the experiment was designed to look at a comparison of two different conditions. In the first condition the client would receive both music and a low frequency tone and in the second condition the client would receive only the music. The outcome of this experiment showed a more significant decrease in tone when the low frequency tone was used than when music

alone was used. All other variables in the experiment were kept constant, and blood pressure and heartrate were additionally monitored. This particular research has shown a statistically significant result in favour of the use of low frequency sound in this treatment process (Wigram and Weekes 1989).

Further research carried out by Wigram and Weekes looked at the effect of the treatment on clients who have oedema. Measurements were made on three clients who had oedematous legs, and in this instance the difference was much smaller. However, the results did show a statistically significant improvement when low frequency sound was used, and the effective improvement in circulation caused the shifting of fluids, and a reduction in the size of the limbs. In real terms, however, the reduction was not great, and a comparison needs to be made between the use of low frequency tone as against the elevation of legs as a normal means of reducing oedema.

In conclusion, there is now an increasing body of evidence accumulating to support the efficacy of using low frequency sound and vibroacoustic therapy programmes to treat certain conditions. A fair comparison of the influence of low frequency sound include evidence of all research in which low frequency sound has been used. In situations where people were exposed to low frequencies of considerable intensity, work was mainly undertaken to protect them from such frequencies. Inevitably, further research was undertaken to look at the effect of low frequency sound on metal by the aircraft industry, and in more recent times research has been undertaken by the Defence Departments of NATO, which is highly classified and consequently unavailable. Mention of this is only made to highlight the variety of areas in which the effect of sound is being looked at, and the considerable influence and impact it has made on mankind. In the highly specialised area of music therapy, the use of free and atonal improvisation in a creative process aimed at developing a relationship through interaction with clients still relies on the fundamental principle, common to most, that high frequencies have the effect of raising tension, whereas low frequencies have the effect of relaxing. Consequently the choice of equipment used in improvisation, the tone and timbre of the instruments and the way they are played reflect much of the current treatment principles of vibroacoustic therapy. Consequently it can be expected that in evaluating the efficacy of music therapy, consideration should be given to the physiological effect of the sounds. In the meantime, there is a considerable amount of further exploration that is at present being planned and undertaken to define more clearly the effects of vibroacoustic therapy, and its value as a prescribable treatment.

Olav Skille is a Musician and Educator working in Norway, Tony Wigram is Head of the Music Therapy Department, Harperbury Hospital, Radlett, Herts, Lyn Weekes is Senior Physiotherapist at Harperbury Hospital, Radlett, Herts.

References

Alvin, J. (1975). *Music Therapy* (revised edition). London: John Clare Books.

_____ . (1976). *Music for the Handicapped Child* (second edition). London: Oxford University Press.

_____ . (1978). *Music Therapy for the Autistic Child.* London: Oxford University Press.

Benenzon, R. O. (1981). *Music Therapy Manual.* Springfield, Illinois: Charles C. Thomas.

Broner, A. (1978). *The Effects of Low Frequency Noise on People — A Review.*

Carrington, M. E. (1980). Vibration as a training tool for the profoundly multiply handicapped child within the family. Lecture given at Castle Priory College.

Forster, A. and Palastange, N. (Eds.) (1985). *Clayton's Electrotherapy Theory and Practice.* London: Balliere Tindall. Chapter V, 165-180.

Lehikoinen, P. (1987). *Vibro-Acoustic Treatment to Reduce Stress. Unpublished.*

Nordoff, P. and Robbins, C. (1971). *Therapy in Music for Handicapped Children.* London: Victor Gollancz.

_____ . (1977). *Creative Music Therapy.* New York: Harper & Row.

Savage, B. (1984). *Interferential Therapy.* London: Faber.

Skille, O. (1982). Musikkbadat — en musikkterapeutisk metode. Musikkterapi nr 1 s. 24-27.

_____ . (1982). *Musikkbadet — anvendt for de svakeste.* Nordisk tidsskrift for spesial pedagogikk nr 4 s. 275-284.

_____ . (1985). MUBS — ein diagnostisches Hilfsmittel (in Spintge/Droh (eds) *Musik in der Medizin.* Editiones ROCHE 237-250.

_____ . (1986). *Manual of Vibro Acoustics.* Steinkjer: Private publication.

_____ . (1987). *Rapport fra symposium 13-15.* VibroSoft.

Stillman, B. (1970). Vibratory Motor Stimulation. *Australian Journal of Physiotherapy.* XVL: 118-123.

Wigram, A. and Weekes, L. (1985). A specific approach to overcoming motor dysfunction in children and adolescents with severe physical and mental handicap using music and movement. *British Journal of Music Therapy* 16(i): 2-12.

_____ . (1989). A project evaluating the difference in therapeutic treatment between the use of low frequency sound (LFS) and music alone in reducing high muscle tone in multiply handicapped people, and oedema in mentally handicapped people — Paper (unpublished) to the Internasjonale Brukerseminar Omkring Vibroakustisk Behandlingsmetodikk in Steinkjer.

_____ . (1989). Collaborative Approaches in Treating the Profoundly Handicapped. *Paediatric Physiotherapy Newsletter* 51: 5-9.

_____ . (1987). Report on a two day conference on the effective use of vibroacoustic therapy (Levanger, Norway). Steinkjer: VibroSoft.