DIMENSION OF MUSIC THERAPY IN REHABILITATION OF PERSONS WITH CEREBRAL PALSY

Alica Vančová, Margaréta Osvaldová

Comenius University in Bratislava, Faculty of Education, Institute of Special Pedagogic Studies, Slovakia

Abstract

Individuals with cerebral palsy are characteristic for speech disturbances. It is indicated that brain centres controlling speech and understanding of speech lie close to the primary motor cortex and in the area of cerebral cortex that happen to be the most affected especially in case of quadriparetic form of cerebral palsy. In case of dyskinetic cerebral palsy, speech disturbances are caused by incoordination of muscle groups due to dyskinesia. Therefore in this group of children it is very important to pursue musical intervention using purposeful vocal and technical exercises, song repertory enabling solving a certain breathing, vocal and articulation problem. Apart from having a way to cultivate speech, it is necessary to point out how adequate vocal exercises may be used creatively when establishing the correct vocal and singing habits of individuals with cerebral palsy.

Persons with cerebral palsy have their ability to perceive rhythm and its periodicity preserved. The speed of creating regular movements differs and represents their own tempo. Musical rhythm that stimulates, accompanies and regulates physical movements represent a great help in physical therapeutic performances. Musical and rhythmical activities bring them to realise the intimacy of their being, know the obstacles imposed by their own body and the effort it takes to cope with individual movement elements, develop the sense for balance, distance estimation and to adapt their movements and gestures to the dimensions and share of space.

The aim of this work is to present the possibilities for applying complex music therapy with individuals affected by cerebral palsy.

Key words: *cerebral palsy, rehabilitation, neuromuscular coordination, muscle and joint strengthening, kinetic muscle control, coordination, flexibility, muscle balance, respiration*

The influence on music on people was already known in ancient Egypt, Greece, India, and China. The tribes of ethnic nations applied music not only a part of their rituals but they also believed that music had a kind of healing power. According to Kresánek (2000, p. 20) in the above mentioned cultures the connection of music with singing, playing musical instruments and dancing contained a dynamic, subjective expression element having a positive impact on the psychosomatic state of individuals. Currently music is used as a treatment in clinics, hospitals and rehabilitation centres.

Music therapy as one of the art therapies has a complex impact on people. It applies music, rhythm, sounds, tones, singing often connected to motion. The therapeutic method represents creating and participating in music, its reception, perception or other creative processing. Music therapy employs verbal as well as non-verbal instruments. Verbalisation is possible by singing, melodisation and rhythmisation of words, by outcries or whispers. We work non-verbally with music, rhythm and with sounds.

As mentioned by Gerlichová (2012) different parts of the human body resonate with different sounds and tones. Using tones we can apply music therapy to release pressure in different parts of the human body or to stimulate them. Singing and breathing exercises have a large effect on further bodily and psychic processes. Music may bring relax, irritation or stimulate energy. Apart from the above mentioned facts, music, rhythm and sounds are instruments of mutual communication and expression of the inner human world.

Music therapy interventions for the development of motor functions of individuals with physical and multiple disabilities (overview of literature)

Based on the anthropologic constant factor it is well-known that being active is a natural human need. The core of music therapy movement is the idea that individuals with physical and multiple disabilities have a natural need to move, play, speak and make music. An important role of the therapist is to develop this need of individuals to be active, act and create, lead the person in order to have their musical feeling developed and stimulate them to gradual expression." The above idea presents acceptance and development of natural human needs to be active.

A human being is able to perceive and emotionally and aesthetically experience rhythmical relations in music and react to them by motion. Rhythmical feeling has deep roots in human personality. It is manifested in the musical development of individuals even before perception of the melody. (Sedlák, 1989, p. 31, 67, 68). Upon perception of music, a connection between hearing and motor analyser is established that intervenes with the muscle groups ensuring adequate movements manifested outwards as for example: *drumming the rhythm with their feet or hands, movements of the head, trunk but even of eyelids. Motor response to music may be also of internal character such as for example: muscular contractions of the rib cage, diaphragm, vocal chord tensioners, acceleration and deceleration of respiration, heart palpitation.* These reactions may be the easiest to be monitored in the music perception of ***children***, whose expressions are more spontaneous and less controlled than the expressions of adults. ***The reactions of children*** to rhythmical music elements such as *clapping hands, indications of dance motions, and changes of mimics may be observed already at early age.*

Thus the rhythmical music element is closely related to human motor function. According to Kantor (2009, p. 139) distinct, accented or syncopated rhythms are developed from low to high tension and evoke taste for movement. When connecting music with physical motion, rhythmical regularity and predictability of the musical happening is important. Mainly little accented rhythms in slow tempo have a relaxing effect. Lullabies form a suitable mean for calming down tension, psychosomatic relaxation, whose rhythms evoke rocking motions.

In pedagogic practice the opinion is maintained that the sense for rhythm is conditioned by inborn abilities and therefore not everybody may acquire it. However, researches (Sedlák, 1989, Staum, 2000, Gerlichová, 2012) prove the opposite of the above statement since a positive effect to rhythmical feeling may not only cultivate this ability but there is also improvement in the muscle function of individuals with physical and multiple disabilities (e.g. relaxing of the muscular tonus in case of spastic form of CP).

As stated by Mátejová (1992, p. 25) even a person with multiple disabilities has his/her ability to perceive rhythm and its regularity preserved. The speed of creating regular movements differs and represents their own tempo. Musical rhythm that stimulates, accompanies and regulates physical movements represent a great help in physical therapeutic performances. Musical and rhythmical activities bring them to realise the intimacy of their being, know the obstacles imposed by their own body and the effort it takes to cope with individual movement elements, develop the sense for balance, distance estimation and to adapt their movements and gestures to the dimensions and share of space.

Music therapy is often used with individuals affected by physical or multiple disabilities in order to improve the coordination of limbs, stimulation and renewal of the neurokinetic connections.

Respiration

In case of children with acute respiration difficulties, the authors Judson, Bolger, 1984, Lee, 1985 recommend a receptive form of music therapy, e.g. listening to slow parts of symphonies, music of non-European nations, world music, exotic music, New Age (meditation music inspired by the Orient), Indian music and gamelan orchestras from islands in the Pacific Ocean.

Apart from receptive music therapy, singing also contributes to respiration improvement and moreover stimulates the coughing reflex and cleans the respiratory tract. Breathing when singing imposes higher

claims on people than speaking. From the physiological, aesthetic point of view the most suitable is the so-called missed breathing. Correct breathing means to take in only as much air as to have the breath controllable and vocal chords protected from excessive air pressure.

A suitable musical instrument for doing correct breathing exercises is also the fipple flute. Its task is to deepen breathing and to learn to control physiologically correct in-breath and its direction. This pursues prevention of adverse effects, such as respiration arrhythmia, talking during in-breath and collision between breathing and speaking. By playing the flute children combine pleasant elements with useful ones. **Púčiková (200, p. 59) emphasises the task of *fipple flute* in the prevention and early discovery and elimination of errors and disorders in communication**. When playing the flute, neck muscles are relaxed, which is the basis of rehabilitation voice exercises when treating children's hoarseness or stammering. Regular rhythmical wobbling of the tip of the tongue helps to train the vocal organs and is a suitable exercise aimed at articulation improvement.

Strengthening of muscles and joints

For strengthening muscles and joints Burnett, 1985, Cofrancesco, 1990, Staum, 2000 recommend playing wind instruments (fipple flute, clarinet, trumpet) muscles are strengthened also by the actual holding the weight of for example the clarinet during interpretation. The efficiency of utilising social dances was accented in their researches (Baker, Hudson, 1989; Palmer, 1977); however, at the same time they also emphasised cautiousness upon repeated strengthening of muscle parts and monitoring the level of fatigue.

Kinetic muscle control

Under kinetic muscle control we also understand coordination and power that may be improved through music activity. For example in case of children with CP, with incontrollable spontaneous motions of limbs, after attending a music and gymnastic program and playing musical instruments positive changes were observed (Cohen, 1993). In the researches mouth-organ and piano were used using which children acquired control over muscles in the arms, shoulders, fingers and hands.

First of all regular playing the piano, when the effort of the performer is to create an aesthetically pleasant music experience, may motivate the player to endurance upon achievement of the desired result. When playing the piano, due to sound and aesthetic reasons, they must observe correct posture of the body (head, neck, spine, legs and hands). In particular hands (starting from relax in the shoulders, arms, elbows and wrist) are important for creating a quality tone.

Neuromuscular coordination

In the literature for physical therapy in connection with music therapy the utilisation of certain elements of ballet and dancing, athletics, and physical exercises are mentioned (Bornell, 1984, Kennard, 1983, Pickett, 1980). Further studies and researches (Nordoff, Robbins, 2006, Gerlichová, 2012) focused on the improvement of muscular coordination by the application of conducting, playing musical instruments, singing that mediate rhythmical and melodic elements important for efficient movement coordination.

Mobility/skilfulness in neuromuscular coordination

The target of music therapy of individuals with multiple disabilities, who feel pain with any move, is to develop mobility and skilfulness within neuromuscular coordination. Staum (2000) states the use of music and electronic PC program through which the client is stimulated to move certain parts of the body and accompany music sound effects. This way the individual is motivated to repeatedly create the necessary movements that develop mobility and skilfulness, and at the same time provide him/her

with joy from playing. Currently touch tablets are employed to a large extent, which imitate the sounds of musical instruments (guitar, synthesiser, drums). For example Misa Digital Kitara has six "strings", the touch display is completed with buttons on the neck replacing frets. The corpus has the appearance of a classical electric guitar and apart from the display and the buttons in the rear part it does not contain any further operating elements. The display is not only an operating element; it also provides graphical interpretation of playing the instrument. Inside the corpus there is a synthesiser working with the possibility of different sound effects. Also Apple in cooperation with Macintosh created an operation system with a camera that is capturing the movements of multiply disabled individuals and according to them played the sounds of musical instruments, which at the same time also stimulate clients to put the finishing touches to the music and sound colouring by movements of different body parts (Lipský, 2012).

Balance and coordination of movements

In the 1980s Boxhill, 1985, Pickett, 1980 selected dancing activities in the achievement of balance and coordination of movements. They recommended using the Eurhythmics of E. J. Dalcrose (1908), whose choreography of Eurhythmics is based on slow rhythmical and motional creations (stretching of muscle parts in different positions) applied in the integration of improvised dance performance and thus help to keep balance and coordinate movements.

Music stimuli for muscle movements

Music is often used in physical activities since by using melody and rhythm it motives the disabled individuals to motion. Staum states (2000, p. 76) that children with CP react extremely positively to rhythmical music that increases their activity in motion. A positive example is rhythmical interpretation on the djembe drum through which individuals involve and develop the muscles. A motivation for playing the drums may be regular and sudden contrast changes in rhythmical pulsation, meter, song tempo, which stimulate to motion. Just like regular repeating of stressed beats in the composition and clear direction of the melody may lead to higher motional endurance and stimulate individuals to enhanced movements.

Muscle relaxation

Relaxation music is often quoted in the literature for muscle relaxation. However, in some cases it may also evoke muscular tension. Due to these reasons it is recommended that active music therapy, such as motion, dance, playing musical instruments, etc. precedes music relaxation.

Scartelli, 1982 points to the efficiency of applying relaxation music to reduced undesired, spontaneous movements. Positive changes occurred also in case of individuals with spastic form of CP where the stiffness and tension of muscles was significantly reduced (Rider, 1985). Frego (1995) in his researches accented the use of eurhythmic program that also contributes to muscle relaxation and at the same time reduces stress.

Vocal expression

Singing is the most natural musical expression of a child and is the basic for activating the individual in the process of music therapy. It significantly contributes to the ability to distinguish tone relations, develops musical memory, imaginativeness, teaches the individual to express emotional feeling.

Another primary function of singing is to support the vocal abilities and communication of individuals with multiple disabilities. Children are able to sing collocations that they are not able to pronounce when speaking. Through playing with a song, respiratory and vocal exercises individuals get to know

the rules of communication and at the same time they penetrate into the melody of spoken word, learn to correctly articulate words and expressions. (Procházková, 2010).

Even in the research composer and pedagogue Z. Kodály (quoted according to Sedlák, 1976) the most significantly documented was the transfer of development of ear for music and singer skills to creation and quality of vocal and conversation expressions of children. Musical and expression instruments that are connected in the musical perception and musical activities, such as melody, rhythm, dynamics and tone colour, participate in the quality of communication abilities.

In case of individuals with multiple disability, singing also has an important role and that mainly in development of vocabulary and improvement of information. Songs and musical activities are often used in learning and improvement of education concepts, such as shapes, colours, numbers, spatial relations (up, down, to the left, to the right, inside, outside, in front of, behind) but also of time relations like first, second, and last (Gfeller, 1990). Songs with text are created in a similar way when children get to know the information on weather, seasons, punctual time, letters of the alphabet, etc. We can also use upon acquirement of the elements of graphomotorics.

Rhymed text in songs supports learning and development of memory skills. If there is a lack of songs with adequate contents, or they are not suitable for the set target, the music therapist may create his/her own text that corresponds with the topic being discussed. They proceed from seeking rhymes to individual words up to creating individual verses. Then we either insert them into the melody of a known song (also folk song), or into the melody created by us. Singing songs is a strong instrument when supporting self-realisation of an individual with multiple disability.

Group singing brings clients to common contact, and at the same time also provides anonymity of the performance and the opportunity for relaxation. Common singing becomes an instrument for sharing cultural traditions, attitudes and certain ways of thinking and experience.

A suitable song may express a certain mission, tell a story or to propose different alternatives for behaviours and thinking of an individual. In connection with deepening of social sensitiveness, we can use songs with the topic of values and virtuousness. It creates space for repeated living through, modelling and prevention of social and educational situations in sound form and their shifting into the experience and emotional sphere. (Osvaldová, 2012). Using so-called contact compositions (e.g. *hi songs and goodbye songs*) used regularly as introduction and conclusion, the clients acquire the necessary social behaviour, such as for example eye contact during greeting with the other one or shaking hands. Contact songs are short, easily learnable songs sung by the therapist or individuals in a group. The therapist addresses the individuals by their names and talks to them through the text of the contact song. When singing, eye contact between the therapist and client is important. The therapist should welcome the client and introduce him/her to the group and express his/her acceptance this way. The contact song motivates the addressed client to interaction with other individuals in the group, helps him realise himself, the environment he is in and the relationship to other members in the group.

Singing songs has unlimited therapeutic options for individuals with physical and multiple disabilities, which are conditioned by professional and creative approach of special pedagogues.

Vocal education

The condition for good quality vocal expression, as well as suitable reproduction of a song is systematic improvement of vocal skills. It concerns the development of singing abilities, skills and habits. It mainly refers to correct posture while singing, regular breathing, creating singing, vocal tone and correct articulation, and at the same time to systematic extension of the vocal range.

Respiratory exercises

Breathing when singing imposes higher claims on people than speaking. Breathing while singing consists of three phases: 1. *breath, 2. holding the breath back (relaxation of breathing) and 3. breathing out.*

Motivation exercises for children are breathing exercises connected with the following imaginations: blowing into a feather, paper handkerchief, lead, bubble blower (try to create the largest possible bubble or many small bubbles), blowing using a drinking-straw into a bottle with water, scattering paint stains on a paper, blowing to the back of the hand or into the palm connected with writing letters, numbers and short words), blowing into a propeller (try to make the propeller spin as long as possible with one breath, to blow off as many seeds of a dandelion in bloom as possible), blowing coloured paper or polystyrene balls along a marked space, etc.

Breathing may be improved also by using rhymes, riddles and different short texts, texts of songs, counting while holding their breath back.

Creating a tone

Vocal start – "soft onset of tone with the aim to free the throat and necessary activity of the respiratory system is in vocal education a hygienic and aesthetic requirement. Cries and outcries with a hard vocal start damage the voice; the vocal chords collide with each other.

Soft vocal start is facilitated by the imagination of *touching a soft fur, plunging the finger into honey, involving the move of hand in the process of tone creation, from consonants these are mainly "m-n-ň-v-h-j" (Slovak letters).*

The sound of voice in resonance – Equalisation and harmonic connection of the head and chest resonance with breath support is the basis of sound complexity and balance of the voice. Voice resonance provides the voice with capacity and glamour.

Creating a tone in the front, in the mask at the beginning we induce by simple resonance exercises in the medium voice position in the scope of some tones, e.g. *growl of a car* (the exercise is similar to humming, it gives sound to resonance spaces of the head, with fading out of tones on syllables *bim, bam, bom, mim, mam, mom* with following education of humming, etc. Other motivations are also efficient. For example we quickly stop the horse with *prŕŕŕ*, frighten away the birds with *frŕŕŕ*, we imitate a frog concert by *krŕŕŕ*, the bellow of bees in a hive by *bzzzzz.*

For inducing the raised arch Procházková (2007) considers it efficient to use the following suggestions: we yawn with mouth open, at the back in the mouth we have a small ball, which is growing, in the mouth we have space like in a cave or cathedral, we extremely wonder at something (the English *wow*), somebody unexpectedly stepped on our feet and we cry out (*ouch*), we have our mouth at the back on the neck, *we parody an opera singer*, etc.

When creating a higher vocal position, it is necessary to induce a head tone, which is performed from f^{i} above and weaker dynamics on vocals *u, o*. It is suitable to motivate children using the following imaginations: we are surprised *júúú*, we imitate a pigeon *vrrrúúú*, owl *húúú*, cat *meow*, cow *mooh, booh*, siren of a police car *hooh-hooh-hooh*, the echo in a cave *hooh-hooh-hooh*. Some of the above mentioned exercises may be used from up downwards also in integrating the voice; it is suitable also to involve the movement of hand into tone creation.

Articulation

Singing requires understandable and clear pronunciation. According to Sláviková (2003, quoted according to Procházková, 2007), articulation is a coordinated activity of the respiratory, phonatory and resonance apparatus.

In case of individuals with multiple disabilities we meet clumsy and little understandable pronunciation connected with insufficient opening of the mouth.

Examples of exercises for relaxing the articulation organs:

- we chew a chewing gum (exercise for relaxing the jaw and mimic muscles), first politely with open mouth, then impolitely, e.g. as if bored,
- relaxing the jaw may be easily induced by your hand put under your chin, the chin touches the back of the hand when talking or singing,
- relaxing the root of the tongue may be achieved by putting out and pulling back the tongue into the mouth cavity, its movement among the corners of the mouth, licking the teeth and the outer gums, moving the tip of the tongue to the left and then immediately to the left cheek.

We articulate in order to talk with a hearing impaired person, everything we say or sing he must be able to read from our lips. The activity of articulation shall even more accentuate singing without voice; however, the articulation organs work in the imagination.

We indicate examples of exercises to improve the expression abilities in speech:

- We talk in pairs as two little frogs (relaxation of the jaw, tongue), horses (relaxation of lips, mimic muscles), cats, hens, dogs, etc.; within the conversation we create a certain program, for example the horses are tired, or carried a heavy cargo; the hen is happy because her chicks have just hatched; the cat is terrified because it has become lost and is looking for it mom (Tichá, 2007).

  Examples for correction of vocalisation:

- Levelling of vocals using sounds as j, ň on one tone, jiii, jeee, jaaa, jooo, juuu, niii, neee, ňaaa, ňooo, ňuuu. (Note: in broad vocalisation it helps if the above exercise and/or text song is performed by forefingers placed to the corners of the mouth).

Vocal range

It is suitable that the therapist creates an overview of the vocal range of clients. In case of those having a narrow vocal range we recommend working individually and select songs with a small range, re-transpose them rather to their vocal position and after certain reinforcement to move to the right position. Vocal exercises and songs with a small vocal range help to start up singing of clients. At the same time it is suitable to use a melodic musical instrument (piano, violin, xylophone, etc.), which should not overtone the singing or to conceal deficiencies.

Vocal exercises help to develop the function of the respiratory apparatus, basic singing habits, vocality of the voice, models with higher ambit improve mobility of the voice, contribute to extend the vocal range, lead to more precise articulation, at the same time improve continuity of speech (Osvaldová, 2012).

Application of musical instruments in music therapy

Playing children's musical instruments has great importance in the development of musicality and motor skills of individuals affected by multiple disabilities. As mentioned by Kopinová (2003), it proved its worth among children with difficulties in singing. Playing musical instruments enables them to actively join the process and acquire musical experience that helps to eliminate the causes of singing disorders (insufficiently developed ability to recognise and perform the level of tones), to develop fine and gross motor skills.

In music therapy through playing the musical instruments *musical improvisation* of the actual participants is applied resulting from their personal enjoyment that is naturally connected with speech and movement.

Improvisation is connected with human self-realisation depending on the momentary level of their abilities. During improvisation playing we can see the phenomenon of psychic welfare with the individual that we perceive in case of a child being deeply plunged into playing. Improvisation is a spontaneous process where inner human imaginations and acquired motor skills join in one creating a complex.

Keetmannová (1974) states that improvisation is a process based on precise rules that we must have control over of. **The therapist plays a crucial part, who should understand the musical and also the out-of-musical expressions of individuals.** A therapist should have a clear vision of the extent of improvisation (limited or free), of the targets that we want to achieve by improvisation. Improvisation is based on firm knowledge and rules of the game. Free improvisation does not mean lacking any plans. Freedom is perceived here as free space, the opportunity for various thematic and dance creations and the courage to handle instable situations. Cognitive demands determined by it shall be adequate to the group, age and situation whether it concerns limited improvisation where the support is ostinato accompaniment, burdon or free improvisation whose course is determined by agreed rules of game in group.

According to Nordoff Robbins (2003) improvisation activities offer the individual space for free musical expression, spontaneity and playfulness. With development of improvisation skills the rigid behaviour patterns may change. Researches prove that in many cases there is change in behaviour during improvisation affected the quality of life of a person with multiple disabilities.

Orff's, folk and ethnical instruments are extremely stimulating since with easy manipulation with them interesting sound effects may be produced that motivate the musical activity of individuals. Jugmairová (2003) characterises them as instruments bringing to the surface the inborn music making of people and which efficiently communicate without words. By playing the instruments they materialise sounds and tones that one produces from inside him.

Their advantage is that they stimulate making music. Orff (1964, quoted according to Blažeková, 2009) stated the following opinion in this respect: *"It has been verified that if children or adults get hold of instruments of primitive orchestra, they start playing music on them by themselves. The play gradually goes into improvisation. The need to plays is transformed into performance that the player is capable of in the given moment and it motivates him/her further after having coped with simple playing to face other challenges of playing musical instruments. Orff's instrumentarium is not a closed up set of instruments".*

In this connection Orff stimulated to continuous seeking of new sound opportunities, to extension by instruments of other cultures as well as by instruments and sound toys made by one's own hands.

Joining music with movement

As claimed by Keetmanová (1974), the unity of movement, speech and music is given to human and conditioned by rhythm. This rhythm conditioned unity is the starting point when learning, acquiring skills and abilities also in the area of movement, speech and music.

It shows for example in singing and making music: singing and making music have different quality if movement in space is transferred into it, experienced on one's own body; with dynamics and rhythmisation we achieve live "moving singing".

When acquiring music, movement plays an extremely important role. As observed by Orff (1964, quoted according to Jungmair, 2003) *"elementary music never stands alone; it is connected with movement, dance and speech. It is a complex human expression, its anthropologic constant factor. Catharsis is produced by implementation its integrity."*

Keetmanová in her publication called *Elementaria* (1974) elaborated didactic procedures where she applied the principle of speech, movement and music making integrity. For example to stimulate and support of movement, Keetmanová (1974) recommends using speech, singing, humming, exclamations, playing on the body, playing rhythmical and melodic instruments. The teacher should

apply empathetic approach during instrument based accompaniment of movement, should be able to estimate the tempo and rhythm of walking, running, and gallop, length of steps different in individual age categories of children.

The accompaniment should not be monotonous, dynamic changes should be applied and offset instrument accompaniment – make a pause, use instruments with analogical sound properties, involve the accompaniment into four to eight strokes.

As mentioned by Kantor (2009), and Dalcrose also in his musical and movement method called Eurhythmics focuses on natural movement that corresponds with the rhythm of music. Movement and dance become the dominant element in the therapy process. Music perception interiorisation occurs through movement as well as development of music and non-music abilities. These are motor function experiences resulting from the rhythmical movements and muscular coordination.

Movement games form a natural form of musical and movement activities. Musical and movement games represent a strong motivation source and raise the activity of individuals, as well as the music experience and feeling of joy. This fact should be used mainly in early school age when the movement games with music have the most expressive effect for the musical and aesthetic development of a multiply disabled child.

Joining music and movement games has multiple significance. As claimed by Baranová (2010) the most important include the following:

- stimulation and intensification of the emotional experience,
- activation of all children,
- regeneration of the child's psychic,
- development of memory, perception, attention, and fantasy,
- coordination of movements and development of motor skills,
- raising experience from music,
- development of musical abilities,
- getting to know the expression instruments of music (rhythm, tempo, tact, dynamics),
- providing optimal space for children's creativity.

Through musical and movement games and activities, the individual learns to correctly use power, train the sense of rhythm and good and fast orientation in space is facilitated. On the physiologic side, these activities are important for strengthening the inner organs and their functions; they have an impact on circular and respiration system and reinforce the activities of lower extremities. They also help to create new, relatively complex movement stereotypes, improve the quality of neuromuscular coordination and lead to good posture of children. From the educational and social point of view, mainly the sense of children's cooperation in collective is supported (Kos, 1984, quoted according to Baranová, 2010). According to C. Orff (1964) methodical procedure of musical and movement activity arises out of the integrity of music, speech and movement. Therefore the basis for the development of movement abilities will be formed by rhythmisation and melodisation of words, rhymes on one, two or up to three tones, singing songs accompanied with playing on the body – *clapping*, *pattering*, *stamping*, *snapping*, *tapping*. Tactual and acoustic movements are the primary tools for rhythmisation, expression of tempo, dynamics, and colour. According to Langsteinová (2000, p. 25) an efficient musical and movement activity is movement dramatisation – individuals may impersonate the contents by movement – the story of the song, composition. One must take into consideration mainly the emotional side of music and aesthetic impressiveness of movement. The therapist strives to make the clients experience music in motion, create and feel the harmony of collective movement and avoid making movement mechanical.

Musical reception

Perception abilities for music are developed the most intensively through listening to music. It depends on the internal capabilities of the person, environment and situation when perception takes place and the type of the perceived song. The creative elements in music perception are connected with experiences that are in line with hum activity and may contribute to self-knowledge of the individual, establishing their taste, development of association processes, emotional reactions, etc. They mentally relax the multiply disabled individual, and have a cathartic, stimulating, mentally hygienic and therapeutic meaning. Based on the theses of Orff's Schulwerk (1964) the establishment of creative elements supports some perception components:

- *associations* that are connected with music perception may be further developed through different imaginations, ideas and feelings,
- *emotions* that are by the effect of music extremely strong and often appear also in rhythmical body movements.

As stated by Orff (1964) in musical perception also some creative elements are applied, which transform into the psychic of the perceiving person:

- *element of invention and change*, which is established upon capturing and experiencing music variations of rhythmical structure, alternation of music images, change of tones, and transition from one tone into another. These musical changes support the establishment of emotions, change the dynamics of mental condition and accelerate development of personality,
- *condition of dreaming and starting up fantasy.* Music stimulates the establishment of fantasy imaginations and pictures, tears the preceptor out of ordinary life and his/her relation to the environment, supports sensorial associations. In case of many listeners it creates day dreaming, which appears as meditation, contemplation, relaxation from the general behaviour pattern, as well as the ability to draw attention to themselves. Dreaming stimulates to action and enables problem solving,
- *experience effect*, which is the most important in music and appears as a sequence of experiences connected to each other. Music has its exposition, tension, resolution, peaks and also relax, contrasts (height, dynamic, rhythmical, melodic, agogic, etc.). It is expression of the inner world of people, artistic transformation of the outer world and contains experiences from the musical creative act, from life experiences (feeling of joy, sadness, expectation, admiration, and love). In the music experience we join the past with the future, memory with premonition, external stimuli with internal impulse. The experience may be reinforced if it is in line with our momentary mental state (e.g. live optimistic music reinforces joy of life) and is in line also with the physiological processes (excitement, relaxation, etc.). One of the strong experiences in musical perception of works is the feeling of *amazement*, which contains different levels: unexpectedness, mysteriousness, admiration, enthusiasm, astonishment.

It is characteristic for perception that the processes of change, putting the finishing touch, dreaming, fantasy and experience are closely related and often mutually supported. The entry of music into human psychic stimulates creative processes, creates personal traits, and supports personality dynamics and aesthetic orientation.

According to K. Bruscia (1998, quoted according to Kantor, Lipský, Weber, 2009) suitable selection of music may stimulate establishing contact and improve communication among the clients. With an individual it supports the ability of listening, evocation of body reactions, relaxation, development of hearing abilities, motor skills, evocation of fantasy and imaginativeness, socialisation and others. Bruscia indicates some ways of listening to music for individuals with multiple disabilities:

- somatic listening – uses vibrations, sounds, music in different forms
- music relaxation – through the music there is relaxation, reduction of stress, tension, inducing of body relaxation achieved
- stimulation listening – stimulation of senses, increasing the energy level, uplift mood
- eurhythmic listening – listening to music affects motor behaviour of the client, breathing, speech, fine and gross motor skills, movement procedures
- reflexion of the song – talking about the song, questions related to the topic important for the student.

Interconnection of music reception with other activities

Listening to music is often understood as an independent activity. Pursuant to Orff's Schulwerk for active perception and enjoying of music motivation through improvised accompaniment on musical instruments, motional or artistic expression is needed. Physical movement as per Orff's Schulwerk is stimulated by different characters of music, enables to better understand individual musical expression elements and the musical contents. Improvised accompaniment of the listened to music sample on musical instruments, or conductor gestures are also used. A very efficient method is connecting listening of music with improvised artistic expression, namely by drawing or painting – finger painting, music based painting, playing with lines, etc. (Mátejová, Mašura 1992). A child understands and perceives with all senses and musical aesthetic experience must also take place on a broad sensory base. From the artistic aspect, in this creations inspired by music artistic quality is crucial.

Complex music therapy in rehabilitation of individuals with multiple disabilities

In the present understanding we see rehabilitation as comprehensive that consists of several elements that mutually overlay. The first stage is represented by medical rehabilitation followed by social rehabilitation and labour rehabilitation (with children and youth it is pedagogic rehabilitation). Apart from the mentioned elements the following also ranks here: psychological, legislative, economic, architectonic, technical rehabilitation, the questions of free time, etc. The complexity of rehabilitation is conditioned by their mutual interconnection and coordination (Gerlichová, 2012).

This rehabilitation has a broad scope and may not be without team cooperation of the concerned experts. As a process it represents a set of target-specific, contentually process-like and functional-structural interventions, enabling interaction between the pedagogy of multiply disabled persons and its objects (persons with multiple disability) with the aim of their socialisation in a biodromal framework (Vančová, 2005).

According to Kantor (2012) when using music therapy in rehabilitation, it is recommended to coordinate cooperation with team experts:

- cooperation with doctors is important for suitable indication and monitoring development of the client's condition,
- cooperation with a psychologist includes consultations, some forms of psychotherapy, etc.,
- cooperation with physiotherapists determines the goals for doing exercises with body parts, re-education of movements using the rhythm of music, training of music, etc.,
- cooperation with ergo therapists helps to define the areas for training grasping, transfers, application and manipulation with compensation tools, etc.,
- cooperation with speech therapists (e.g. using melodic and intonation therapy),
- cooperation with other special pedagogues includes rehabilitation of cognitive functions (e.g. memory, attention, orientation in space), remedy of specific learning disorders.

As stated by Vančová (2005), therapy is an activity focused on renewal or improvement of homeostasis and elimination of the impaired balance between the organism and the environment. The aim of the therapy is to remove pathology, restore harmony inside the organism and in its relationships with the environment and thus harmonisation of their complex personality.

Application of music therapy in rehabilitation represents a very broad area with different methodics for individual types of disability or impaired health. The main targets of music therapy, apart from the mentioned physiotherapeutic ones, for individuals with multiple disabilities are:

Self-acceptance

The effort is to help individuals seek new qualities of life. Self-reception is reflected from the multi-sensorial experience in interpersonal space and reaches its peak at the level of self-esteem. The target of music therapy is, through extended self-reception and reception of one's environment, to reinforce the client's self-esteem and activate their communication, socialisation, emotional, motor and cognitive sources for creating a healthy existence.

In musical and creative captivation the clients often do not think about their disability and frustration and have the possibility to fulfil themselves in the role of a conductor, musician, and actor, perceive their personality from another aspect. Through group music therapy, the client has the possibility to get to know their positive and negative sides, and learn to accept their personality. By focusing on their positive side of personality, they may pursue self-esteem through positive experience from their own musical activity, feeling of success or through playing musical instruments, singing, active participation in public events, different music competitions. Long-term positive results in music interpretation and musical creative activities participate in increased self-esteem of a person.

Communication

The aim of music therapy is to develop communication in the form of verbal and non-verbal expression and also to create suitable interpersonal relationships. The client also acquires different forms of non-verbal communication through playing musical instruments, playing on the body, signs, and alternative communication tools. Working with speech and voice through vocal exercises and song is also important.

Socialisation

The essence of the socialisation process in music therapy is represented by interactions, based on which the clients correct their behaviour and take up new roles. Efficient group music therapy is in which the clients learn mutual cooperation, assertiveness, and empathy towards their environment.

Expressing emotions

Emotions are an important part of human personality. Clients often suppress their emotions. Through music therapy they have the possibility to express their certain feelings via musical improvisation. Through these activities abreaction leading even to calming down occurs.

Development of rhythm and motor skills

Many clients suffer from the disorder of rhythmical feeling and expression. Rhythm may be cultivated by different exercises, which is reflected in movement, speech but also in time organisation of the day, activities, etc.

Musical rhythm that stimulates, accompanies and regulates physical movements represent a great help in physical therapeutic performances. Musical and rhythmical activities bring them to realise the intimacy of their being, know the obstacles imposed by their own body and the effort it takes to cope with individual movement elements, develop the sense for balance, distance estimation and to adapt their movements and gestures to the dimensions and share of space.

According to Lipský (2012), rhythmic drumming activates sensorial and motor centres in the brain, which are not stimulated in general practice. There is gradual harmonisation and synchronisation of the brain hemispheres due to which the physiology of brain waves changes. Drumming indicates electric cycles in the brain, which are not utilised in everyday activities. At the same time there is also increased production of endorphins evoking euphoria. Zeleiová (2007) also indicates cyclic character of rhythmic tools when the periodicity of repeating the same musical rhythmical forms has the function of psychic stabiliser since it creates the feeling of safety and security.

Education focused on listening

Clients learn to listen to their environment through music reception. After having listened to a music sample, they share their feeling on the effect of music. An important part is relaxation, to let the music take its effect and realise its effect in the given moment.

Reinforcing concentration and attention

Most of the clients with multiple disabilities suffer from concentration and attention disorder. Techniques are implemented in music therapy within which there is intentional elimination of perceptivity to certain elements of the perception field, while at the same time the required perception is activated. For example the client with eyes closed perceives the source and place of sounding higher, lower tones, string instruments, etc. Also in relaxation the client concentrates on relaxation of certain body parts.

Correction of memory

In short-term memory exercises we emerge from the hearing analysis of the heard music sample and its interpretation. We train the brain also by reminding of songs listened to in the past, or of music motives, songs or events related thereto.

Other music therapy targets among individuals with multiple disabilities involve:

- reduction of stress and anxiety,
- handling pain and discomfort,
- positive change of mood and state of emotion,
- active and positive participation in the course of treatment,
- emotional closeness to family and the therapist,
- meaningful spending of free time in a positive and creative way.

As stated by Gerlichová (2012) within music therapy we go through together with the client through stages of coming to terms with disability or disease:

- aggressive reactions,
- looking for a culprit regarding disability,
- depression, sadness,

- denial of reality – the client unrealistically believes in full recovery, rationalisation is also one of the defence mechanisms (rational acceptance and explanation leads to suppressing certain emotions),
- regression – the client places himself in the role of a younger dependent person towards his environment,
- accepting the disability as a part of reality but without consequences,
- acceptance of reality – challenge to overcome obstacles and seek new targets in life and roles in the society.

Upon application of music therapy for clients with multiple disabilities, we use group (four to eight clients for a period of 90 minutes) and individual form. Short-term and long-term therapeutic plan is important for the therapy. Parents should also participate in the therapy, who establish close and immediate participation in the therapeutic process. Without the help of parents it is not possible to observe the possibility of long-term and stable results of remedy (Vančová, A., Morochovičová, T., Smolianinov, A.G. 2011, p. 14).

The music therapy process consists of:

- introduction – motivation and start-up,
- preparing exercises aimed at for example working with emotions, rhythmic exercises, singing, training communication (verbal and non-verbal), working with orientation in space, training of hearing analysis, etc.
- main topic of the therapy,
- sharing,
- relaxation.

Individual form of music therapy is applied in case of people with apathetic syndrome. Resonance musical instruments are used, which are placed on the palm, back, legs, and so on. Communication channels are being sought based on the principles of basal stimulation. The music therapy process may be analysed based on rhythmical expression, singing, hearing analysis, movement with music, expression through playing musical instruments, etc.

Music therapy has a complex impact on people. As one of the forms of artistic therapy, it may represent also a significant improvement in the quality of life of each individual with physical and multiple disabilities.

From the research

A client with cerebral palsy, 35 years old

The client quadroparetic form of cerebral palsy. It showed in tense muscle tone, mainly in the right extremities. The client has impaired fine and gross motor skills, his movements are uncoordinated, grasping is very weak. The consequence is low rate of self-service activities. The client has developmental dysphasia. His verbal expression is hardly understandable, makes simple sentences and has below average vocabulary. The client is also characterised by hyperactivity, motional restlessness, often alternates activities. The boy is slightly mentally disabled, his personal tempo is slower, he has a low level of concentrating attention, and his psycho-motor development falls behind the average of the children of his age.

We attended 90 music therapy sessions with the client.

In case of quadroparetic cerebral palsy, speech disturbances are caused by incoordination of muscle groups due to dyskinesia. Therefore in this group of children it is very important to pursue musical intervention using purposeful vocal and technical exercises, song repertory enabling solving a certain breathing, vocal and articulation problem. Apart from having a way to cultivate speech, it is necessary to point out how adequate vocal exercises may be used creatively when establishing the correct vocal and singing habits of individuals with cerebral palsy (also referred to as CP).

Within music therapy intervention we also focused on the **development of fine and gross motor skills, visual motor coordination** through drumming on an African djembe drum. Drumming on the djembe drum has efficient resonance effects on human psychosomatics, it has an abreactive effect, and at the same time also develops rhythmical feeling (which is showed in a higher courage to move, systematic time organisation of the day, in the number of activities). The expressions of children during musical improvisation on djembe help the special pedagogue to recognise certain personal traits of the child that are little visible in ordinary activities. Playing the drums reinforces assertiveness of children that find it harder to verbally express themselves and are less assertive, and on the other hand corrects the behaviour of those having inclinations to manipulation and aggression. These activities help to develop the ability of active listening, empathy, respect, acceptance, tolerance, and cooperation.

For the development of fine and gross motor skills in visual motor coordination we emerged from the rhythmical interpretation of folk songs, rhymes, word games, through which we utilised sudden contrast changes in rhythmical pulsation, meter, tempo of the song, which stimulate to motion. Just like regular repeating of stressed beats in the composition and clear direction of the melody led to higher motional endurance and stimulated the client to enhanced movements. In order to improve muscular coordination, at the beginning of the game we involved fingers, wrist and later elbow and gradually used the weight of one hand starting from the arm. We were putting the drum further from the client, which stimulated him to bigger movements.

The improvised playing the djembe drum included abreaction (relaxation of the inner tension of the client), through resonance of the instrument there was a legitimate space for ventilation of negative emotions and to charge new energy.

At the beginning while playing we were holding the client's hand and were drumming into the rhythm of the song. Then we were playing separately on two instruments. The target was rhythmical interpretation of the given songs; later we used the principle of imitations and then improvisation. The boy at first played with one hand quietly, slowly, arrhythmically but during the other sessions we perceived a more rhythmical, louder drum interpretation in faster tempos. The spasms on the hands relaxed to that extent that the client was not playing with his fingers but with his palm and upon interpretation he was able to alternate his hands.

Another activity was dance and musical-motional songs, conductor movements in the rhythm of the compositions of W.A. Mozart, A. Vivaldi, Saint Saens, etc. The aim was to improve **movement coordination**, keeping balance, to be able to connect song with movement, through simple movements to dramatise the song being listened to, and at the same time to reduce spontaneous movements.

Connection with movement was not easy. At first we performed the movements together. The client reacted to the common activity positively and by gradual regular musical and movement activities, the client took courage to move independently. As the time went by, he accelerated his movements, was dancing to the rhythm of the song in his wheelchair. After ten sessions the client took courage to stand up and move using support.

The last activity was playing the fipple flue; the aim was to improve **fine motor skills of the fingers, visual motor coordination, cognitive process** (attention, concentration, ability to distinguish notes in the note chart, orientation in the notation record develops spatial relations (up, down, to the left, to the right, in front of, behind) or of time relations (rhythm, tempo, etc.), reduce salivation, improve regular respiration. Using the fipple flute, we strived to deepen breathing and to learn to control physiologically correct in-breath and its direction.

At the beginning the client did not control the breathing out flow, which also showed in the sound of the instrument; however, he gradually learned to employ slow breathing out and the technique of using the tongue when creating tones. Regular rhythmical wobbling of the tip of the tongue helped to train the vocal organs and improve articulation. We consider it to be a demanding task to use fine motor skills (fingers) when playing melodies of individual songs. We took as basis the material of Ladislav Daniel (School of Playing the Fipple Flute that contains folk songs of different nations, melodically adjusted also for individuals with slight mental disability. At first the client found it hard to distinguish the notes in the chart of notes, and to connect them with playing. Individual notes h1, a1, g1 we called Anka, Hanka, Gretka; this way the boy could realise the position of individual notes in the chart of notes through a certain image, he acquired the rhythmical values of notes through the method of imitation, we played individual passages of compositions that the client repeated.

For the correction of speech, communication, cognitive abilities, psychosomatic relaxation we used specialised breathing and vocal-technical exercises, song repertory, which enable to solve a certain breathing, communication, speech and articulation problem and development of vocabulary.

At the first two meetings the client manifested an apathetic attitude to singing activities. He was singing very quietly and hardly opened his mouth; the reason was fear of new and unknown musical interventions. Therefore our effort was aimed at his maximum stimulation and motivation to sing. An efficient approach for development of communication skills was the introductory song of the music therapy session “Hi song” (according to the sample of Nordoff, Robbins, 2006), in which through eye contact, singing and instrumental accompaniment we said to the client "Hi, Hi, Janko, Hi"! The task of the client was to greet us with singing: Hi!

In order for the client to overcome barriers in singing, we applied humming singing (according to Lipský, 2012) in the lowest possible position of the client’s and our ambit in the time duration of one minute (humming in the lowest vocal positions has an extremely relaxing effect). It was followed by humming in the highest possible vocal position in the same time duration. Then each of us was singing humming in their own medium vocal position within which we worked with vocal improvisation. While performing vocal activities, the client started to realise his vocal range, the possibilities of working with voice, the colouring of the harmony of two voices. Within further vocal activities we observed that the experience from common improvisation freed him up from paralysed approach to singing.

Then we proceeded to the well-known song repertory and the client had the chance to select songs (he prefers the character of cheerful folk songs). Upon learning the text of the song or rhyme we were faced with a lengthy process of memorising text. After multiple repeating of the text he learned it only partially; however, we perceive it as a positive step in developing his memory abilities and development of vocabulary. Within relaxation we were singing also slowly lullaby songs that reinforced him in psychosomatic relaxation. We performed relaxation in different forms after each

session. At first the client had problems with relaxing during relaxation. Motional restlessness was present. Only after multiple repeating of this activity he was able to find a place on the carpet, lie down and listen to music. He was always relaxing with his eyes open. We were singing the songs with piano accompaniment with emotional load and temperament and the client gradually acquired the emotionally tuned method of interpretation.

During the following sessions the client's trust in vocal interventions showed to a larger extent. The systematic approach of vocal activities consisted of the following procedures: first we paid attention to breathing exercises, we applied associations through in-breath of scented flowers, breathing in for two strokes, short holding back, for two strokes breathing out. After that we played to be a light breeze, breathing in for two strokes, holding back and for four strokes soft breathing out. We used the bubble blower. At the beginning the client breathed in air for one stroke. However, gradually by regular exercises he acquired four-stroke breathing out.

After fifteen music therapy sessions we can observe that the vocal and technical interventions had a positive impact on the psychosomatic relaxation of the client and his communication also improved. Vocal exercises helped him to relax spasms at the level of face and articulation organs, and it was reflected in the continuity of speech and intonation and at the same time in a better quality articulation.

Presentation of results

The most serious problems in the activities is represented by the client's cerebral palsy. The boy likes movement very much but diparesis limits him to a substantial extent. Therefore in movement games he is often unsuccessful. Our aim is to propose such activities that will be attractive for him and will also help him develop his motor functions.

We combined musical and movement games with singing and a short rhyme in order to fulfil the goal of developing verbal expression abilities. The client reacted very positively to the games. In his case it is important to maintain the principle of progressiveness and to join two activities into one only after they are both independently acquired.

Our client seeks social contacts therefore we consider group form of activities to be suitable for this purpose. In group music therapy there is not much space for individual approach, which is seen by us as a disadvantage of the group form. The boy often requires help of the lecturer. Individual approach may help us to ensure higher efficiency.

Conclusion

Complex music therapy of disabled individuals bring them to realise the intimacy of their being, know the obstacles imposed by their own body and the effort it takes to cope with individual movement elements, develop the sense for balance, distance estimation and to adapt their movements and gestures to the dimensions and share of space.

The application of complex music therapy among physically disabled, sick and health impaired individuals does not only have a positive effect on the correction of bodily and health condition but at the same time also improves the intellectual and cognitive, sensory and motor and psycho-social domains.

Résumé

This literature review of music therapy and physical rehabilitation encompasses applications of singing, instrumental playing, movement/dance, listening and conducting for the restoration of physical abilities in motor impaired individuals. The use of instrumental performance is therapeutically directed according to the physical requirements of the instruments and the physical limitations of the individual, with necessary mechanical or procedural adaptations. Music instrumental

exercises are provided primarily for coordination, strength, and endurance. There appears satisfaction and motivation: many children will strive to attain rhythmic muscle movements while working with a band.

Movement/dance activities are commonly implemented in physical rehabilitation to stimulate movement, develop coordination and control, and to increase the range of motion and general mobility.

Both passive and active listening activities are reported in the literature to stimulate movement or relax muscles.

The flexibility lies in the features of music, which can be paired with various physical objectives. For instance, slow/fast tempo to movement speed, loud/soft dynamics to hard/soft efforts. Motor tasks can then be performed to these rhythmic and qualitative features to produce specific muscular patterns. Music influences the precision of physical movement when it is adapted to the task.

Longer period of practice brings unusual attentiveness, motivation, enjoyment in the process of rehabilitation. If individuals attend, learn and experience happy productivity, the process is considered a success.

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