Raymond MacDonald, Gunter Kreutz, Laura Mitchell: „Music,Health, & wellbeeing“.
S. 257 - 275, in Kapitel 19 „Music as Non-Pharmacological Pain Management in Clinics“. Günther Bernatzky, Simon Strickner, Michaela Presch, Franz Wendtner, Werner Kullich, Oxford University Press, 550 Seiten, ISBN 978-0-19-958697-4, 1. Aufl. 2012

Chapter 19

Music as Non-Pharmacological Pain Management in Clinics*

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Introduction

The capacity for music to stimulate social-emotional processes and to affect our moods in everyday life is now well evidenced (Panksepp and Bernatzky 2002; Hesse 2003; Koelsch 2005; Dileo 2008).

As such, this powerful stimulus works on social-emotional processes and affects our moods in everyday life and can have various beneficial health effects. Chapters throughout this volume suggest increasing empirical evidence that music may be effective as a non-pharmacological intervention in clinical as well as non-clinical contexts. Specifically, music can alleviate pain, stress, and feelings of depression in individuals suffering from acute and chronic pain (e.g. Mitchell et al., Chapter 17, this volume). Music stimulation may also relieve negative cognitions such as feelings of helplessness and hopelessness and undesired stresses that many patients experience especially in clinics (e.g. Spintge, Chapter 20, this volume).

The specific aim of this chapter is to evaluate the effects of music on acute and chronic pain in inpatients with and without surgery. There are two goals; first to present an overview of research, and second to address issues surrounding the implementation of music in pain therapy for inpatients.

Pain is still a major healthcare problem. Postoperative pain remains a great challenge despite sufficient treatment concepts, including systemic and regional analgesia techniques (Pschowski and Motsch 2008). Appropriate pain management is still unavailable to the majority of patients (Breivik et al. 2006). Whereas the efficacy of systemic and regional analgesia techniques is well evidenced, only a few references show the efficacy of non-pharmacological management of pain (Nadler 2004). Music as one of such non-pharmacological interventions has not been thoroughly established. Music has been found to affect and stimulate many different parts of the brain and body. It has a remarkable power to stimulate many social-emotional processes and to influence emotions in everyday life. This emotional power is used as a non-pharmacological intervention in some clinical pain patients.

Music can be seen as a very old therapeutic ‘drug’. Apparently, all human cultures, including indigenous and ancient ones, have used music for therapeutic purposes (Gouk 2000; Horden 2001). Music, often in association with ritual chants and dances, was considered as a healing

* We dedicate this chapter to Prof. Gerhard Harrer (Salzburg, Austria) who has died shortly some weeks before his 95th birthday. Prof. Harrer’s ground-breaking studies include investigation of the heart-rate of the conductor Herbert von Karajan, during conducting as well as during flying his airplane.

resource. For example, ancient Egyptian frescoes from the fourth millennium BC depict music therapeutic interventions. Although there seems to be no way to reconstruct the sound of such interventions, Egyptian priests presumably used incantations to influence fertility in women. The oldest written documents mentioning the use of music in the context of mystic or religious healing ceremonies are Assyrian cuneiform tablets dating from the second millennium BC. The Greeks (Pythagoras) and Romans also used music and rhythm to heal sickness and injuries. Hebrews and Greeks treated physical and mental illness by playing music. The healing effects of music were recognized even in Grecian times, where it was employed as a mainstream psychiatric treatment. The Greek 'physicians' Zenocrates, Sarpander, and Arien were the first to use music therapy as a regular practice. They employed harp music to reduce seizures in cases of mental illness (Shapiro 1969). In the Middle Ages, music was used therapeutically in medicine (Spintge and Droh 1992). In the twentieth century, scientifically-oriented research into the therapeutic effectiveness of music has drawn commensurate attention (Cunningham et al. 1997). Nickel et al. (2005) documented selected articles to give music therapy a scientific reputation based on empirical evidence. The results of their investigations have shown that music therapy is an effective intervention for patients with chronic pain, children with migraine, and patients with chronic tinnitus. In future trials, an emphasis should be put on a comparison of music therapy with standard treatments.

Music has a strong influence on emotion (Blood et al. 1999; Panksepp and Bernatzky 2002; Altenmüller et al. 2007), stress (Winter et al. 1994; Lee 2003; Salamon et al. 2003a,b; Esch et al. 2004; Pelletier 2004), relaxation (Gauthier and Dallaire 1993; Duffy and Fuller 2000; Kemper and Danhauer 2005), sleep disturbances, and pain (Panksepp and Bernatzky 2002; Kullich et al. 2003; Hesse 2003).

In recent years, a mounting number of studies follow principles of evidence-based medicine. These studies have shown the effectiveness of defined interventions and suggest music as a powerful resource for the treatment of various illnesses (Hillecke et al. 2005; Bernatzky and Strickner 2008) and that engagement in musical activities has strong effects on the human brain. It exerts effects on subcortical brain centres and has a strong influence on the psychological and physiological state of the organism (Panksepp and Bernatzky 2002; Hesse 2003).

Limbic and paralimbic systems show strong changes caused by listening to music in following regions: the ventral striatum, amygdala, anterior cingulate, and auditory cortices in relation to processing musical emotions (Blood et al. 1999; Blood and Zatorre 2001). At the same time other structures which are associated with the endocrine system are also influenced by music (Quiroga et al. 2011; Kreutz et al., Chapter 30, this volume).

Music in medicine for therapeutic benefits

Perioperative music stimulation has evolved as an increasingly common therapeutic strategy in surgeries (see Spintge, Chapter 20, this volume). But when talking of music in medicine, it is important to take the problem of terminology into consideration. We have to distinguish first between music stimulation and music therapy.[1] Music stimulation has various possibilities that include habitual or designed listening to the radio at home as well as the involuntary hearing of music in waiting rooms or in the supermarket. Many people are not pleased about this involuntary aspect, but music can be applied in a controlled manner as a therapy with curative effects.

[1] Definition of music therapy. Available at: http://en.citizendium.org/wiki/Music_therapy (accessed 28 January 2010).

Listening to music has its power in the arousal of emotions. These emotions, whether elicited by sounds, or as a result of associations in patients' memories, can become topical in therapeutic conversations to enhance self-experience and coping strategies. In active music therapy, the therapist sings and plays instruments together with the patients and encourages them to improvise.

Music and its power as a non-pharmacological treatment

It is well documented that music affects heart rate (HR) and its variability (HRV) (Trappe 2009). Musical accents and rhythmic phrases appear to resonate well with physiological variables. Reactions to music are considered subjective, but studies suggest that cardiorespiratory variables are influenced under different circumstances (Bradt and Dileo 2009). It has been shown that relaxing music significantly decreases the level of anxiety in a preoperative setting to a greater extent than orally-administered midazolam (Bringman et al. 2009). Higher effectiveness and absence of apparent adverse effects make preoperative relaxing music a useful alternative to pharmacological substances like the sedativum midazolam for premedication. However, carefully selected music that includes a patient's own preferences may offer an effective method to reduce anxiety and to improve quality of life. Anecdotal evidence suggests that classical and meditation music are often perceived as beneficial whereas heavy metal music or techno-sounds could be ineffective or even induce physiological stress.

Music (listening) can help to reduce pain and anxiety in patients undergoing haemodialysis (Pothoulaki et al. 2008). Patients were assigned to a music group, where they listened to their preferred music and to a control group without music intervention. Changes of anxiety and pain were included in the measurements. At the end of the study the control group had significantly higher state anxiety scores and significantly higher pain intensity.

Many studies have shown that inpatients gain an advantage by listening to music. Music played to premature babies may help to reduce their pain and encourage better oral feeding (Schwartz et al. 2004; Cignacco et al. 2007). There are also trials, which provide preliminary evidence for therapeutic benefits of music for specific indications. As well as pain reduction, benefits most often reported were to physiological parameters such as heart rate, respiratory rate, and oxygen saturation. Other studies (51 studies including 3663 subjects), synthesised in a Cochrane report, (Cepeda et al. 2006) have shown that listening to music reduces pain intensity levels by more than 50% and reduced opioid requirements. Participants exposed to music had a 70% greater probability of having at least 50% pain relief than unexposed participants. This is equivalent to the so-called number needed to treat of 5 (NNT=5; this means that 5 people out of 100 are necessary to get a relief of pain of 50%). These studies included people with pain during a diagnostic or therapeutic procedure such as colonoscopy, lithotripsy, with postoperative pain as well as chronic non-cancer pain, cancer pain, labour pain, or experimental pain. Nevertheless the magnitude of these benefits is small and therefore the clinical importance is still unclear (Cepeda et al. 2006). In a systematic review on online-databases from 1998–2007, Engwall and Duppils have found influences of music on postoperative pain (Engwall and Duppils 2009). Different types of music and different kinds of surgery were performed in the 18 studies considered in this report. A significant positive effect on postoperative pain was found in 15 studies and the use of analgesics was lower in the music groups in four studies. The conclusion was that music can be used as a low-priced adjuvant for the relief of postoperative pain.

Kullich et al. (2003) reported that listening to certain music during both acute and chronic pain leads to a significant pain relief and further improves sleep quality and quality of life. Sixty-five patients suffering from low back pain were randomly divided into two therapy groups: one with

standardized physical therapy accompanied by music and instructions for relaxation, the other group without music. A specially-produced music for application with pain was listened to once daily over a period of 3 weeks by CD and headphones. The global pain (visual analogue scale, VAS) as well as the pain on pressure improved significantly. The Roland–Morris Disability Questionnaire for low back pain revealed that the subjective disability in the group with music therapy improved more distinctly than in the control group. Music therapy showed a positive influence on sleep disturbances due to chronic low back pain as measured by the Pittsburgh Sleep Quality Index (PSQI).

Cancer patients can benefit from music interventions according to a recent review (Richardson et al. 2008). Music therapy (in conjunction with conventional cancer treatment) helped patients to manage stress better, to learn how to communicate their sadness and fear, and to alleviate discomfort and physical pain, leading to a better quality of life.

Pain, anxiety and the efficacy of music therapy in children during clinical procedures were of interest in a systematic review (Klassen et al. 2008). Three hundred and ninety-three studies were included, whereas only 19 studies met the inclusion criteria (e.g. randomized controlled trial, children aged 1 month to 18 years). Although the methodological quality of the studies was generally poor, it was shown that music therapy significantly reduced pain and anxiety in children undergoing medical procedures. These authors concluded that music can be considered as an adjunctive therapy in clinical situations that produce pain or anxiety.

Music (therapy) also has powerful effects on carers of advanced cancer patients (Magill 2009). Prior to the death of close relatives who had received music therapy, seven carers completed open-ended interviews. They said that the music affected them directly, but also the joy they felt was based on remembering seeing the patient happy during the music therapy. The sessions helped them to bring back happy memories, to connect with themselves, with others and the time 'beyond' and so alleviate the 'psychological' pain. All in all, music can help to find a meaning through transcendence and can give strength to the carers through memories of joy and empowerment.

Cancer patients often suffer from fatigue, pain, and sleep disturbance. To examine the influence of different interventions, including music (therapy), a literature search was conducted (Kwekkeboom et al. 2009). A categorization based on the type of intervention was made: relaxation, imagery/hypnosis, cognitive-behavioural therapy/coping skills training [CBT/CST], meditation, music and virtual reality. Fatigue, sleep disturbances and experienced pain improved through imagery/hypnosis and CBT/CST interventions. Pain and sleep disturbances ameliorated with relaxation techniques and meditation had positive effects on fatigue and sleep disturbances. Music interventions have demonstrated efficacy for pain and fatigue.

Next to increased relaxation, music has been used to reduce anxiety and distress. One example is the use for patients with coronary heart disease (CHD), who often have a higher risk of complications due to severe distress (Bradt and Dileo 2009). The conclusion of a review indicated that anxiety in patients with CHD decreased but the results were inconsistent across the 23 studies. Also, a reduction of respiratory rate, rather, and blood pressure was found, as well as a small and consistent pain-reducing effect.

Zhao and Chen (2009) provide evidence that the valence of music (pleasant vs. unpleasant) is more crucial than mood (happy vs. sad) in affective modulation of pain. They describe tonic heat pain to be significantly reduced through both happy and sad melodies and that the valence of music appears to be the mediator of the hypoalgesic effect of the different music.

The effect of low volume, classical background music in doctors' surgeries was evaluated in another study (Zalewsky et al. 1998). One hundred and eighteen people completed the questionnaire: 95% did not feel disturbed by the background music, 89% found to feel better, and 80%

thought the music enhances the doctors' efforts and therefore leads to a better patient–doctor interaction.

Pyati and Gan (2007) discussed a reduction of analgesic use such as opioids like tramadol, NSAIDs (non-steroidal anti-inflammatory drugs) like paracetamol, and other non-opioid analgesics and their combinations. Furthermore, the usage of non-pharmacological therapies such as acupuncture, relaxation, music therapy, hypnosis, and transcutaneous nerve stimulation as a substitute for conventional analgesic therapy needs to be discussed to achieve an effective and successful perioperative pain management.

Music as an analgesic tool in surgery

Anxiety, stress, and sleep disorders can often be found in postoperative pain. These components also exist before surgery. As pain is a subjective feeling it is experienced differently by everyone. Mainly the mental toughness and the physiological component play an important role. Psychological factors such as anxiety, depression, etc. increase the effect of pain which affects as a physiological stressor and thus the feeling of pain and pain intensity. In addition, the emotional factor is a crucial component of how pain is perceived (Bernatzky et al. 2007).

Mok et al. (2003) showed that patients, who were allowed to choose music for themselves, had significantly less stress, a reduced HR and blood pressure compared to patients, who did not listen to music. These patients underwent minor surgical procedures with local anaesthesia.

The influence of music before surgery

Before surgery, psychophysiological stress is particularly strong. Therefore, music stimulation is used in some surgeries to minimize anxiety and to reduce pain (Heitz et al. 1992; Cunningham et al. 1997; Spintge 2000). Music also provides a compensation for ambient noise. A relaxation-promoting music stimulation in combination with spoken relaxation instructions influences affective, cognitive, and sensory processes and therefore has reducing effects on pain and stress. In addition, there is the emotional aspect, such as attention and social support in the care of patients.

A standardized perioperative therapy with a music programme, including guidance for relaxation, contributes to health promotion in an effective and competitive way. The objective of one study was the evaluation of such a standardized music programme before and after surgery (Miller et al. 2002). Patients were divided into a music programme (A) and a comparison group (B). Both patient groups had comparable body mass indices (BMIs), sleeping indices (PSQI), and wellbeing indices before surgery. Postoperatively, the PSQI improved significantly in Group A and the consumption of analgesics decreased. Also the patients of this group needed no hypnotics or sedatives, whereas in Group B three of 10 patients needed hypnotics after surgery. Regarding the VAS for pain, Group A reported less pain. Concerning the postoperative need of the nursing service, no difference was reported. There was also no difference in the duration of the hospital stay after surgery. In respect of the scale of wellbeing Group A outmatched Group B. In this study, the number of evaluated patients was too small to calculate a statistical significance and further research is needed.

The influence of music during surgery

As children can experience pain during blood sampling, a comparison of the pain-reducing effects of local anaesthetic cream (EMLA®), Indian classical instrumental music and placebo was undertaken (Balan et al. 2009). VAS scores were significantly higher in the placebo group than in the other two groups (noted by all the categories of observers). The authors conclude that the

pain experienced during venipuncture can be significantly reduced by using a local anaesthetic cream (EMLA^R) or Indian classical instrumental music.

After total knee arthroplasty, massive pain often affects the recovery (Simcock et al. 2008). In this study, patients in a music group had the chance to select their preferred music, while a control group did not listen to music. The postoperative pain scores were measured by VAS. At 3 and 24 hours after the surgery, the music group experienced less pain than the non-music group. The conclusion of the authors is that intraoperative music provides an inexpensive, non-pharmacological option to reduce postoperative pain.

In a systematic review of 42 randomized controlled trials (perioperative settings), music interventions had positive effects in approximately half of the reviewed studies (Nilsson 2008). Music also has some influence during (and after) cardiovascular surgery. Measurable effects, however, are not only on physical pain; music can also have relaxing effects (Nilsson 2009). To measure relaxation, plasma oxytocin, heart rate, mean arterial blood pressure, PaO_2 and SaO_2 were determined in a music group with bed rest and in a control group with bed rest only. Levels of oxytocin, arterial oxygen (PaO_2) and subjective relaxation levels increased significantly in the music group compared to the control group. There were no differences in HR, mean arterial blood pressure, and oxygen saturation (SaO_2) between the groups. These results suggest music as an effective aspect in contexts of multimodal treatment.

Nilsson et al. (2005) conducted a study on intra- and postoperative effects of music therapy on stress and immune responses during and after anaesthesia. Seventy-five hernia patients were examined. Stress responses were measured by plasma cortisol and blood glucose, and immune responses by determining the IgA levels. In this study, it was found that a significant decrease of cortisol levels was achieved by postoperative music intervention. Patients in the music group had less stress, less pain, and required less morphine. However, no changes in IgA levels, blood glucose, blood pressure, HR, and oxygen saturation were noted. The authors suggest that intraoperative music therapy can facilitate a decrease in postoperative pain, and that postoperative music therapy produces a reduction of anxiety, pain, and morphine consumption.

In a further study the authors reported a pain reduction of 16–40% in patients after intestinal surgery with the help of music therapy (Good et al. 2005). In this study, three non-pharmacological intervention groups (relaxation, music selected, and the combination) were compared with a control group. In addition, the authors also highlight that these interventions are recommended in combination with analgesia to gain a greater postoperative relief without side effects.

The influence of music after surgery

The influence of non-pharmacological strategies to reduce pain and anxiety in patients after a total hip or knee arthroplasty was investigated in a study by Pellino et al. (2005). Patients were divided into a group that received usual care and a group that received usual care plus non-pharmacological treatments. On the first and second postoperative day the non-pharmacological group needed less opioid and experienced less anxiety compared to patients who did not use the kit. Significant correlations were found for postoperative pain intensity, opioid use and anxiety. MacDonald et al. (2003), however, reported no differences in pain and consumption of analgesics in people after minor surgery of the foot and those undergoing total abdominal hysterectomy when listening postoperatively to self-selected music. All patients in the music groups in the foot surgery condition reported significantly less anxiety than the control group.

After orthopaedic surgery, wound care is often painful for the patients. One article describes the experience of a nurse who used music therapy to reduce the acute physical pain during wound care (Hsiao and Hsieh 2009). It was possible to reduce pain by an individual music therapy. Additionally, negative feelings decreased and the patients increased their own spiritual strength.

Eighty children aged from 7–16 years were split up into a music group and a control group, the music group listened to music after the day of surgery (Nilsson et al. 2009). A possible reduction of morphine, distress, anxiety, and pain before and after surgery was measured. The instruments were the Coloured Analogue Scale (CAS), the Facial Affective Scale (FAS), and the Short State-Trait Anxiety Inventory (STAI). Children in the music group needed less morphine and their distress was reduced, but no other differences could be seen. Listening to music was 'calming and relaxing' for the children.

Music can help to improve the early contact of mothers with their babies after Caesarean section (Ebneshahidi and Mohseni 2008). The sedative and emetic effects of routinely administered analgesics (opioids and benzodiazepines) may impair the immediate close contact of mother and neonate. In this study, the music was selected by the patients. Anxiety, HR, blood pressure, opioid requirement, and postoperative pain were measured. One group listened to music after surgery for 30 minutes, whereas the other group listened to silence. In the music group, there was significantly less opioid consumption and reduction of pain scores compared to the silence group, while there were no differences in terms of anxiety score, blood pressure, or HR.

Good and Ahn (2008) investigated influences of Korean and American music on subjective pain after gynaecological surgery. Women were classified in a music group, with the option to choose between American piano music and Korean ballads (both plus analgesics), and a control group with bed rest only (plus analgesics). The patients listened to music four times postoperatively. There was significantly less postoperative pain in the music group compared to the control group. Two-thirds in the music group (n=21; 62%) chose Korean music and one-third (n=13; 38%) chose American. Both music styles were equally effective.

Table 19.1 shows an overview of some references that cover the topic 'music and surgery' and emphasizes the importance to discuss and define a standardized music stimulation as a non-pharmacological intervention in pain. Most of the studies conclude that music improves quality of life and sleep and has different effects on the heart rate. It reduces physiological and psychological pain and anxiety before, during and after clinical surgeries. It also reduces stress and depression and leads to relaxation.

Table 19.1 summarizes the cited research studies above of various surgeries with music stimulation or music therapy. The onset of music stimulation and the measured parameters including the results are shown.

Table 19.1 A systematic overview of the effects of music therapy in clinics with or without surgery

Reference	Samples and design	Intervention	music	Point of MI pre/inter/post	Measured parameters and results
Chlan (1998)	n=54 alert, non-sedated pat. receiving mechanical ventilation; two-group, pre-post-test; exp. design with repeated measures; subjects rand. to either a 30-min music condition or a rest period	Artificial respiration	Kl, CW, NA, EL		Anxiety, HR, RR ↓

(*continued*)

Table 19.1 (Continued) A systematic overview of the effects of music therapy in clinics with or without surgery

Reference	Samples and design	Intervention	music	Point of MI pre/inter/post			Measured parameters and results
Zalewsky et al. (1998)	n=118 people completed a questionnaire		Classical background music, low volume				95% did not feel disturbed; 89% felt better ↑ 80% better patient–doctor interaction ↑
Good et al. (2001)	n=468; repeated measures design; rand. assigned to one of four groups: relaxation, music, combination, and control	abdominal s.	NA, H, PO, J			X	Pain ↓
Lepage et al. (2001)	n=50 unpremedicated patients; rand. assigned to listen to music of their choice via headset during the perioperative period (Group I) or to have no music (Group II)	Spinal anesthesia	Pop, J, Kl, NA	X	X	X	Sedativa ↓
Nilsson et al. (2001)	n=110 women; rand. allocated to receive either music or no music	Hysterectomy; varicose vein s.	Calm instrumental music		X	X	Pain intensity, morphine ↓; anxiety, nausea, ibuprofen and paracetamol— fatigue ↓
Good et al. (2002)	n=311, ages 18–70; relaxation, music, and the combination of relaxation and music on pain	Gynecologic s.	Calming music			X	pain, pulse, respiration ↓
Miller et al. (2002)	18 out of planned 40 patients: Group A (music programme): n=8, Group B (as usual): n= 10	S. for morbid obesity	Music programme including guidance for relaxation	X		X	sleep ↑; pain ↓; no hypnotics and sedatives in A

Table 19.1 (Continued) A systematic overview of the effects of music therapy in clinics with or without surgery

Reference	Samples and design	Intervention	music	Point of MI pre/inter/post			Measured parameters and results
Wang et al. (2002)	People choosing self-selected music (30 min self-selected music) and a control group		30 min self-selected music	X			Electrodermal activity, blood pressure, HR, Cortisol and catecholamin—
Kullich et al. (2003)	n=65; rand. allocated to two therapy groups: one with standardized physical therapy accompanied by music and instructions for relaxation, the other group without additional music application: Once daily for 3 weeks	Low back pain	Relaxation music with a spoken relaxation text (imagery journey)				Global pain, pain on pressure ↓ Roland–Morris Disability Questionnaire ↑ PSQI sleep disturbances ↓ improvement of impatient rehabilitation success ↑
MacDonald et al. (2003)	Exp.1: n=40; two groups: music of their own choice and no music; Anxiolytic and pain reducing effect of music Exp.2: n=58 fem., two groups: music/no music	Minor surgery on the foot; total abdominal hysterectomy	Self-selected music			X	Anxiety in music gr. ↓: no difference in pain and consumption of analgetica
Mok et al. (2003)		Minor surgical procedures with local anaesthesia	Self-selected music		X		Stress, anxiety, HR, BP ↓
Nilsson et al. (2003, 2005)	n=75; examined by measuring plasma cortisol and blood glucose, immune responses by determining the IgA levels	Hernia inguinalis s.	Calm instrumental music		X	X	Pain, morphine ↓; anxiety, nausea, fatigue ↓ ibuprofen/ paracetamol — IgA levels, blood glucose, blood pressure, HR, oxyg. Saturation —

(*continued*)

Table 19.1 (Continued) A systematic overview of the effects of music therapy in clinics with or without surgery

Reference	Samples and design	Intervention	music	Point of MI pre/inter/post			Measured parameters and results
Chikamori et al. (2004)	n=50; Two groups: using a simple key-lighting keyboard system in n=37 elderly patients compared with n=13 patients who were not applied MT	Digestive tract		X	X	X	Bliss ↑
Ikonomidou et al. (2004)	n=60; Music group (peaceful pan flute) and no music	Gynecological laparoscopy		X		X	Nausea ↓; wellbeing ↑; vital signs ↑
Voss et al. (2004)	n=61; three groups: randomly assigned to receive 30 min of sedative music (n=19), scheduled rest (n=21), or treatment as usual (n=21) during chair rest	Open-heart s.	NA, H, P, O, J, F		X		Anxiety, distress, pain sensation ↓
Good et al. (2005)	n=167; three groups: RCT: relaxation, chosen music, and their combination	Intestinal s.				X	Post-test pain ↓ (16–40%)
Lee et al. (2005)	n=64; rand. assigned to undergo either 30 min. of music intervention or a rest period	Artificial respiration	CC, RM, KW, LB				HR, RR, DBP, SBP ↓; C-STAI —
Pellino et al. (2005)	n=65; two groups: one received usual care and one usual care plus a kit of non-pharmalogical strategies.	Knee arthroplasty					Less opioid and experienced less anxiety ↓
Harikumar et al. (2006)	n=78; randomized to either not listen to music (n=40) or listen to music of their choice (n=38)	Elective colonoscopy	FS, FL, B, SI, CI, RL		X		DosEs of sedative meds, discomfort ↓

Table 19.1 (Continued) A systematic overview of the effects of music therapy in clinics with or without surgery

Reference	Samples and design	Intervention	music	Point of MI pre/inter/post			Measured parameters and results
Ovayolu et al. (2006)	n=60; randomized into either listening to music (n=30) or not listening to music (n=30)	Elective colonoscopy	Turkish, classical music				Anxiety, pain ↓; wellbeing ↑
Twiss et al. (2006)	n=60 adults older than 65 years; rand. assigned to the control and exp. groups. The exp. group listened to music during and after surgery, while the control group received standard postoperative care	Cardiovasculary s.			X	X	Anxiety, shorter postoperative time of intubation ↓
Jaber et al. (2007)	n=30; intubated group n=15, non-intubated group n=15); rand. assigned to receive either 20 min of uninterrupted rest or then 20 min of MT or the MT first and then the uninterrupted rest period. Patients selected a relaxing track	Intubation	Music of their choice from a selection including different types of music				SBP, HR, RR, BIS score, NRS, RASS ↓
Pyati et al. (2007)	Test of analgesic use such as opioids like tramadol and NSAIDs like paracetamol, and other non-opioid analgetics and their combinations						Pain, opioid consumption ↓
Ebneshahidi and Mohseni (2008)	Test of early contact of mothers with their babies	Cesarean section s.	30 min self-selected music compared to silence			X	Opioid consumption, pain ↓; anxiety, blood pressure, HR—

(*continued*)

Table 19.1 (Continued) A systematic overview of the effects of music therapy in clinics with or without surgery

Reference	Samples and design	Intervention	music	Point of MI pre/inter/post			Measured parameters and results
Good and Ahn (2008)	Two groups: women were classified in a music group; selection between American piano music and Korean ballads (both plus analgetics) and a control group with bed rest only (plus analgetics)	Gynecological s.	American piano music; Korean ballads			X	Post-test pain ↓; no difference in experienced pain between the two music groups
Klassen et al. (2008)	Systematic review of 393 studies on the efficacy of music therapy in children (e.g. RCT, children aged 1 month to 18 years)	Clinical procedures			X		Pain ↓; anxiety ↓
Nilsson (2008)	Systematic review of 42 RCTs						Music has positive effects in approximately half of the reviewed studies, pain ↓; anxiety ↓
Pothoulaki et al. (2008)	n=60; diagnosed with end-stage renal failure; preferred music listening was applied as an intervention	Haemodialysis	Their own preferred music				Pre-post-test: anxiety, pain ↓
Richardson et al. (2008)	Review on the effects of music therapy in cancer patients	Cancer patients	Music therapy (combined with conventional cancer treatment)				Stress management ↑; discomfort ↓ ; physical pain ↓

Table 19.1 (Continued) A systematic overview of the effects of music therapy in clinics with or without surgery

Reference	Samples and design	Intervention	music	Point of MI pre/inter/post			Measured parameters and results
Balan et al. (2009)	n=50 children; a comparison of the pain reducing effect of local anaesthetic cream (EMLA®), music, and placebo was carried out	Venepuncture	Indian classical instrumental music		X		Pain ↓
Hsiao and Hsieh (2009)	Experience of a nurse using music therapy to reduce the acute pain	Wound care *after* orthopaedic s.	Individual-tailored music therapy		X		Pain, negative feelings ↓; own spiritual strength ↑
Kwekkeboom et al. (2009)	Investigation of different interventions on fatigue, pain, sleep disturbances in cancer patients	Cancer patients	Relaxation, imagery/ hypnosis, cognitive-behavioural therapy/ coping skills training, meditation, music and virtual reality				Fatigue, sleep disturbances, pain ↑ (imagery/ hypnosis); pain, sleep disturbances ↑ (relaxation techniques); fatigue, sleep disturbances ↑ (meditation)
Nilsson (2009)	n=40; RCT; two groups: either music listening during bed rest (n=20) or bed rest only (n = 20).	Open coronary artery bypass grafting and/or aortic valve replacement s.	Soothing music		X	X	Oxytocin, PaO_2, subj. relaxat. levels ↑; HR, mean arterial blood pressure, and SaO2 —
Nilsson et al. (2009)	n=80 children aged 7–16 years were split up into a music- and a control group; music group listened to music after day surgery	Day surgery in children				X	Distress, morphine ↓

(*continued*)

Table 19.1 (Continued) A systematic overview of the effects of music therapy in clinics with or without surgery

Reference	Samples and design	Intervention	music	Point of MI pre/inter/post	Measured parameters and results
Zhao and Chen (2009)	n=24; female; pre-posttest; exp. test about happy and sad music	Tonic heat pain	Happy and sad melodies		Pain ↓

Key:

rand.=randomized; RCT=randomized controlled clinical trial; min=minutes; MT=Music Therapy; MI=Music Intervention;

↑ improvement; ↓ reduction; — no changes; B, Bioacoustic; BIS score, Bispectral Index; BP, blood pressure; chir., chirurgical; CC, Chinese Classic; CI, calm instrumental music; Cl, classic music

C-STAI, Chinese State Trait Anxiety Invento ry; CW, Country-Western; DBP, diastolic blood pressure; EL, easy listening; F, American Indian Flute; FL, famous movie songs; gyn., gynaecological; H, harp; HR, heart rate; J, slow modern jazz; KW, classic from Western regions; LB, music with slow beat; NA, New Age; NRS, Numerical-Rating-Scale; O, orchestra; P, piano; PO, piano orchestra; PSQI, Pittsburgh Sleep Quality Index; RASS, Richmond-Agitation-Sedation-Scale; RL, religious songs; RM, religious music; RR, respiratory rate; s., surgery; SBP, systolic blood pressure; FS, folk songs.

Conclusion

With all the different forms of application, music should be used as a concomitant, non-pharmacological form of therapy in the multimodal setting of pain therapy.

Music as this ideal adjuvant therapy has following pros and cons:

Pros: central effect (limbic system, PAG), reduction of medication, configuration of conviction of self competence, no or few side effects, a combination therapy with other pain medications is possible, reduction of anxiety, partially cost-saving due to reduction of drugs, preventive efficient, stimulation of self-repair mechanisms.

Cons: high expectation, (often) long-term effects are not proved, lack of guidelines, sometimes no evidence for effectiveness, need of more randomized controlled studies, poor compliance.

As stressors, pain and anxiety are able to interact. In addition to an increased vegetative agitation, pain causes an elevation of emotional and affective agitation. Especially with surgical patients, it leads to a limited cognition on pain-relevant aspects. This behaviour is regulated by individual locus of control (Rotter 1966) and modulated by expectance of self-efficacy (Bandura 1977). Therefore, it is very important for individual patients to develop effective coping strategies in the presence of pain, stress, and anxiety. Together with a hypothalamic changeover it is possible that music causes distraction and relaxation, which leads to a disruption of the pain–stress–pain feedback-loop. This leads to an alteration of the sensing of pain. Individually chosen music is able to activate inhibitory pain reducing endogenous mechanisms, improve quality of life, and reduce consumption of analgesics. These effects can be reinforced by combination of music and a relaxation guide (Bernatzky et al. 2007, Miller et al. 2002). With continuous application of music this reaction is reproducible and the processes of conditioning lead to a development of competence and to a reduction of helplessness. Adequate music has no side effects and can be combined with the usual medication.

Unfortunately, there is a lack of strict pharmacological or medical applications that correspond to the criteria of quality of natural scientific research. Further studies on long-time effects and contra-indications with a prospective, double-blind randomized and placebo-controlled design are clearly needed. For future studies, it would be useful to know how long the mood effect of music sustains and how specific mood changes are conveyed to the specific emotions by music (Panksepp and Bernatzky 2002).

Evidence shows the effectiveness of music therapy for the treatment of certain diseases. But the question for the source of the therapeutic effects remains largely unanswered (Hillecke et al. 2005). This group has focused on a heuristic model, consisting of five music therapy working factors: attention, emotion modulation, cognition modulation, behaviour modulation, and communication modulation.

In some cases the goal of treatment is not the complete elimination of pain but to manage it and restore functionality (Nadler, 2004).

Summary

Surgery causes stress and anxiety. The implementation of a multimodal pain therapy including non-pharmacological interventions after surgery is still lacking in many hospitals but music can enhance therapy efficacy and should be used as a non-pharmacological intervention in combination with conventional treatment forms. It is also important to evaluate indications and contraindications for music stimulation/music therapy.

Most studies suggest the importance of providing the patients with control over which music to select, when music is selected, at which loudness levels, and the amount of time during which music is played. Although non-preferred music also has its benefits, preferred music has the power to awaken happy memories that can raise spirit and acuity level. For this reason it is important that the patients choose music that makes them happy, not sad.

Acknowledgements

We thank Sokrates-Stiftung (Schweiz), Stiftungs- und Förderungsgesellschaft der Paris-Lodron Universität Salzburg, Paracelsus-University Salzburg, and the Austrian Pain Society for financial support. For checking the English version we thank Mr Keith Ryan (Plymouth, UK).

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