



EFFECT OF MIRROR THERAPY ON PHANTOM PAIN LEVELS IN POST AMPUTATION PATIENT: A LITERATURE REVIEW

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ABSTRACT

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Phantom pain after amputation is ordinary. Phantom pain is challenging to treat, so it will last a long time which will cause depression and anxiety and reduce the quality of life. There are various treatment options: pharmacological (antidepressants, anesthetics) and non-pharmacological (acupuncture, hypnosis). However, there is still no proven effective therapy, so it is necessary to try a non-pharmacological therapy that is safe, cheap, and easy, namely mirror therapy. This study aims to determine how the effect of mirror therapy on the phantom pain of post-amputation patients. Narrative literature review of a publication registered 2017-2021 on Pubmed, ProQuest, EBSCO, and Google Scholar. Search articles using the keywords "amputation," and "phantom pain," and "mirror therapy." This study uses inclusion criteria consisting of patients who experience phantom pain, research in the form of mirror therapy intervention, there is comparison, the study design uses a randomized controlled trial and case report, with results explaining the effect of mirror therapy in Indonesian or English, and indexed by SINTA or SCIMAGO. 8 articles were included in the inclusion criteria. The majority of articles had a randomized controlled trial design of 7 articles and a case report of 1 article. Four articles discuss mirror therapy, and the other four articles discuss mirror therapy with other therapies. Respondents have an age range of 15-82 years, and most are male. Mirror therapy is recommended to be carried out routinely and according to procedures for post-amputation patients. It has been proven to reduce pain scales in patients before and after the intervention. Nurses can use mirror therapy in the client care process during the post-amputation rehabilitation process.

Keywords:

Amputation, Mirror therapy, Phantom pain

BACKGROUND

Amputation is an action to remove one or more parts of the body due to trauma or disease to prevent death (Hanna, 2019). Amputation is chosen when there is a part of the body that damage so that it cannot be healed or has a disease that is at risk of spreading to other parts of the body. The causes of amputation are neuropathy and vascular disease (81,4%), trauma (16,4%), cancer (0,9%), and congenital anomalies (0,8%) (Jorge, 2019).

Although amputation can prevent death, it can also have a negative impact on health (Petrini et al., 2019). The negative impacts are depression and anxiety (Sahu et al., 2016). Another common effect is pain (Pratama, 2018). Pain that appears can be a pain in the surgical wound and usually will appear as special pain after amputation called phantom pain (Pratama, 2018; Rothgangel, 2019). In addition to having similarities (appearing after amputation), the two pains also have differences. The difference can be seen from the place where the pain occurs. Pain caused by a wound will appear in the surgical wound (Redho et al., 2019). At the same time, phantom pain will appear in amputated limbs (Bang and Jung, 2015). Another difference is the cause of the pain. Pain from the surgical wound will be caused by tissue damage (Redho et al., 2019). While phantom pain is caused by the brain not receiving signals from an amputated limb, so the brain considers the limb to be paralyzed, and eventually, the pain will arise (Finn et al., 2017).

Phantom pain is the sensation of pain in the amputated limb. Phantom pain is a common thing experienced after an amputation. The sensations felt during this phantom pain can be in the form of tingling, throbbing, pins and needles, squeezing, or cramping (Bang and Jung, 2015). The onset of phantom pain can vary, namely, appearing one day after the amputation and can also appear several years after the amputation. Patients who experience phantom pain report that phantom pain occurs while performing daily activities such as reading, sleeping, and watching television. There are studies that state that phantom pain will decrease over time, but there are also studies that state that phantom pain does not decrease or even increase (Rothgangel, 2019).

The cause of phantom pain is still unclear, but there are risk factors associated with phantom pain (Collins et al., 2018; Limakatso et al., 2020). According to Limakatso et al. (2020), the risk factors associated with phantom pain consist of 4 risk factors. The first risk factor is a history of pre-operative pain that will increase the risk of phantom pain. The second risk

factor is that people with lower extremity amputations experience phantom pain more than people with upper extremity amputations. The third factor is that people with proximal amputations are more likely to experience phantom pain than people with distal amputations. The last risk factor is that patients who have not undergone pre-amputation counseling have a higher incidence of phantom pain than patients who have undergone counseling.

Phantom pain is an important problem for post-amputation patients. This is because the cause is still unknown, so currently, there are no interventions that have been consistently proven effective (Collins et al., 2018; Aternali and Katz, 2019). When there is no consistently suitable intervention, this phantom pain persists for a long time, causing disruption of daily activities, feelings of anxiety, and depression to a decrease in a person's quality of life (Rothgangel, 2019).

The incidence of amputation in the United States has reached 20,000-30,000 per year, and it is estimated that by 2050 it will increase to 3.6 million people (Syaifuddin, 2016; Yoo et al., 2018). Meanwhile, in Germany, the total number of amputations increased from 52,096 cases in 2005 to 55,595 cases in 2015 (Spoden et al., 2019). In Indonesia, there is a study conducted by Sitompul et al. (2015) at Cipto Mangunkusumo Hospital in January 2008-December 2012 with a study sample of 80 patients suffering from diabetes mellitus, and it was found that as many as 20.3% of patients underwent amputation. Meanwhile, according to a national survey in Germany involving 537 people who had undergone amputation, it was found that 74.5% of people experienced phantom pain (Kern et al., 2009). There is still no research related to the incidence of phantom pain in Indonesia.

The mechanism of phantom pain is still unclear and is still being debated (Yildirim and Sen, 2020). There are many theories that have been proposed to explain the mechanism of phantom pain (Collins et al., 2018). One of the theories is learned paralysis. According to this theory, the brain will still send motor commands to the amputee. However, because it has been amputated, the brain does not receive a return signal that confirms that the limb is moving. As a result, the brain will perceive paralysis in the amputated member. This causes the illusion of paralysis, which ultimately leads to phantom pain (Finn et al., 2017).

Phantom pain treatment can be done using drugs and without drugs (Yaputra and Widyadharna, 2018). Treatment with drugs uses antidepressants, anticonvulsants, analgesics, and anesthetics (Yildirim

and Sen, 2020). In contrast, treatment without drugs can use cognitive behavioral therapy, acupuncture, hypnosis, and mirror therapy (Trevelyan et al., 2015). Effective treatment to reduce phantom pain has not been found because the etiology is unclear, so it is difficult to find a universally optimal treatment for phantom pain (Urits et al., 2019). Handling using drugs is the main choice of treatment for phantom pain at this time, but in this use, side effects are still found and require high treatment costs, so they are less effective when used in the long term (Rothgangel, 2019; Urits et al., 2019). After seeing this incident, complementary therapy is needed to reduce drug use.

Complementary therapy that can be used to treat phantom pain is mirror therapy (Singh and Pawar, 2019). Mirror therapy is often used because it is safe, inexpensive, simple, and easy to practice (Yildirim and Sen, 2020). The use of mirror therapy is done by using a tool in the form of a mirror as a medium and when reflecting with the opposite limb to the amputated limb. For example, if the amputee is a right leg, then the mirror is left. After looking in the mirror, the patient will imagine that the reflection is an amputated limb so that the patient can move the leg or move the leg to a comfortable position to reduce phantom pain (Finn et al., 2017).

Based on the description above, it can be seen that there are many amputations, and indirectly the incidence of phantom pain will also increase, so it is necessary to apply a solution to deal with phantom pain. One of them is mirror therapy. Therefore, it is necessary to summarize the literature that aims to determine the effect of mirror therapy on overcoming phantom pain.

METHODS

The research is in the form of a narrative literature review. This study synthesizes various literature that discusses the effect of mirror therapy on the level of phantom pain in post-amputation patients. The study was conducted according to the PRISMA checklist. The database used for international literature searches using PubMed, ProQuest, and EBSCO. At the same time, the national literature uses Google Scholar. Keywords will be used in research to narrow the search. The English search keyword used is "phantom pain" AND "mirror therapy" AND "amputation." The Indonesian search keyword "Nyeri fantom" AND "terapi cermin" AND "amputasi". The PICOS method was used in this study to develop inclusion and exclusion criteria. At the literature selection stage using PRISMA Flow Chart. PRISMA Flow Chart consists

of 4 stages, namely identification, screening, eligibility, and included. The identification is made by entering keywords until the appropriate journal is found and selecting articles based on the specified year of publication. After entering the keyword found 1107 articles. After that, articles with a publishing year of more than 2016 were selected, and 274 articles were generated. Furthermore, the screening stage is carried out by selecting the articles found based on the appropriate title and abstract. Before that, the Researcher searched for the same journals and found ten similar journals. In the title screening, 95 articles were obtained, and then the abstract screening obtained 12 articles.

The third stage is eligibility or assessing the feasibility of the literature that is owned by selecting the appropriate article based on the inclusion criteria. The inclusion criteria of the study are; 1. The study was conducted on adult patients who experienced phantom pain after undergoing amputation. 2. Discussed the effects of mirror therapy, 3. Design of a randomized controlled trial and case reports. 4 Indonesian or English, 5. SINTA or SCIMAGO indexed. All literature obtained after the eligibility process is eight articles. The last stage is included. At this stage, the quality of the study will be assessed using the JBI Critical Appraisal Tools. The results of all articles >50% so that further analysis can be continued.

RESULTS

Study Characteristics

After selecting the literature, there were eight articles with various research designs, namely one randomized controlled trial, two single-blind randomized controlled trials, one double-blind, randomized controlled trial, one randomized factorial trial, one randomized single crossover study, one randomized semi-crossover, case controls, and one case study. A total of four articles discuss the use of mirror therapy, and four articles discuss the combined use of mirror therapy and other therapies. The research locations are various, namely Germany, India, Pakistan, Cambodia, the United States, and South Africa, and the remaining article does not explain the research location.

Respondent Characteristic

On average, the people who participated were between 15 and 82 years old, and there were more males than females. The smallest total male is 100% (15 people), and the largest total male is 53% (66 people).

Table 1. English Search Keyword

Phantom pain	Mirror therapy	Amputation
Phantom pain	Mirror therapy	Amputation

Tabel 2. Indonesian Search Keyword

Nyeri fantom	Terapi cermin	Amputasi
Nyeri fantom	Terapi cermin	Amputasi

Table 3. PICOS

Criteria	Inclusion	Exclusion
Population/problem	Adult patient with phantom pain	Adults patients without phantom pain
Intervention	Mirror therapy	-
Comparison	There is	-
Study desain	Randomized controlled trail and case report	-
Result	Explaining effect mirror therapy for phantom pain	Don't explain effect mirror therapy for phantom pain
Research year	2017 – 2021	Under 2017
language	Indonesian or English	Other than Indonesian and English
Indeks	SINTA or SCIMAGO	Not be indexed

Tabel 4. Respondent Characteristic

Citation	Respondent characteristic		
	Number of patients	Age	Gender
Finn et al. (2017)	15	18-70	M= 15
Ramadugu et al. (2017)	64	15-62	M = 64
Rothgangel et al. (2018)	75	Adult	M= 52/ F=23
Ol et al. (2018)	45	16	M=44/F=1
Segal et al. (2020)	30	21-82	M= 23/ F=7
Gunduz et al. (2021)	112	18	M=66/F=38
Zaheer et al. (2021)	24	18-60	M=17/F=7
Yildirim and Ken (2020)	1	28	F=1

Study Results

There are five journals that can be seen the decrease in pain before and after being given therapy. In comparison, the other three journals cannot be seen because there is no group with mirror therapy only, and there is no data on pain intensity after mirror therapy. An article that can be seen reducing pain is an article by Finn et al. (2017), Ramadugu et al. (2017), Rothgangel et al. (2018), Ol et al. (2018), and Yidirim & Sen (2020).

The treatment group (mirror therapy) experienced a significant reduction in pain compared to the control group (covered mirror therapy and mental visualization). In the treatment group, the initial average VAS score was 41.4 to 27.5. While in the control group, there was no significant reduction in pain, with the VAS score initially being an average of 35.2 to 48.5 (Finn et al., 2017).

According to Ramadugu et al. (2017), the treatment group (mirror therapy) had a significant reduc-

Tabel 5. Incidence of Phantom Pain by Cause of Amputation

Cause of amputation	Citation						Total
	Finn et al (2017)	Rothgangel et al (2018)	Ol et al. (2018)	Segal et al. (2020)	Yildirim and Ken (2020)	Gunduz et al (2021)	
Trauma	15	25	45	2	1	112	200 (71,94%)
Diabetes	-	8	-	21	-	-	29 (10,43%)
Disvascular disease	-	22	-	2	-	-	24 (8,64%)
Tumor	-	10	-	-	-	-	10 (3,59%)
cancer	-	-	-	2	-	-	2 (0,71%)
And others such as infection	-	10	-	3	-	-	13 (4,67%)

tion in pain than the control group in the fourth week. The average VAS pain reduction score in the treatment group was 1.89, while in the control group, it was 2.2. The treatment group had a significant reduction in pain until the 16th week, with an average VAS value at 8th week of 0.85, at 12th week of 0.35, and at 16th week of 0.15. After switching to mirror therapy in the control group, there was a significant decrease in pain with an average VAS score in the 8th week of 1.23, in the 12th week of 0.78, in the 16th week of 0.33, and in the 20th week of 0.08.

Other studies also mention mirror therapy has the effect of reducing phantom pain. In the group given mirror therapy, the initial score of VAS was 6.7 to 1.6 (Ol et al., 2018). Research by Rothgangel et al. (2018) stated that there was a decrease in pain after being given mirror therapy for four weeks. The average initial pain in the mirror therapy group was 5.7 to 4.2 after therapy.

Another study with a case report design stated that for four weeks of mirror therapy, there was a decrease in pain. The average pain reduction score at week 2 was 1.15 points lower after therapy, at week three, the average pain score was 1.57 points lower, and at week four, the average pain score after therapy 1,57 (Yildirim and Sen, 2020).

DISCUSSION

Respondent Characteristic

Age

The age range of respondents was from 15-82 years (Finn et al., 2017; Ramadugu et al., 2017; Ol et al., 2018; Rothgangel et al., 2018; Yildirim and Sen, 2020; Gunduz et al., 2021; Segal et al., 2021; Zaheer et al., 2021). It turns out that from this range, the

majority have an age of 18 years (Gunduz et al., 2021). According to the Dinas Kesehatan Kota Yogyakarta (2020), the age range of 15-64 years is a productive age. Productive age represents a period when human activity is high, and there is an increased risk of trauma due to traffic accidents and falls from a height so that there is a risk of amputation (Ukibe et al., 2016). Age has no relationship with phantom pain (Sin et al., 2013). In addition to productive age, phantom pain also occurs in the elderly. The elderly is a period of the aging process, so body functions decline, which makes them vulnerable to health problems (Kemenkes RI, 2016). The Elderly has a relationship with the prevalence and severity of phantom pain (Sinn et al., 2013). The research findings are in accordance with the research of Mallik et al. (2020) involving 92 people, 75% (47 people) have an age range of 16-55 years, and 10.86% (10 people) are over 50 years old. From these findings, phantom pain will be experienced by people of productive age and the elderly with an average age range of 15-82 years.

Gender

The result is that there is a big difference in comparison between men and women, namely men by 259 people (77.08%) and women by 77 people (22.91%) (Finn et al., 2017; Ramadugu et al., 2017; Ol et al., 2018; Rothgangel et al., 2018; Yildirim and Sen, 2020; Gunduz et al., 2021; Segal et al., 2021; Zaheer et al., 2021). It turns out that there are more men who experience phantom pain than women. According to Sin et al. (2013), women are generally more burdened with pain and are willing to seek health care so that it is different. Another study supports that 79.34% (73 people) who experience phantom pain are male. Mallik et al. (2020) from the analysis

Tabel 6. Effect of Therapy on Pain Intensity

No	Citation	Kind of therapy	Duration	Frequency	During	Pain intensity	
						baselin e	End of therapy
1	Finn et al. (2017)	MT	1x15 min /day	5 days/weeks	2 weeks	41,4	27,5
		Covered MT + mental visualization	1x15 min /day	7 days/week	2 weeks	35,2	48,5
2	Ramadug u et al. (2017)	MT (intervention group)	1 x15 min /day	7 days/week	16 weeks	-	0,15
		Covered MT(control group)	1x 15 min /day	7 days/week	4 weeks	-	2,23
		MT (control group)	1x15 min /day	7 days/week	16 weeks	2,23	0,08
3.	Ol et al. (2018)	MT	2 x 5 min /day	7 days/week	12 weeks	6,6	1,4
		TT	2 x 5 min day	7 days/week	12 weeks	7,6	1,7
		Combine therapy (MT +TT)	2 x 5 min /day	7 days/week	12 weeks	7,1	0,6
4	Rothgang el et al (2018)	MT	1x30 min /day	5 days/ 2 weeks	4 weeks	5,7	4,2
		Sensomotor exercises	1x30 min /day	5 days/ 2weeks	4 weeks	5,8	5,4
5	Segal et al. (2020)	MT	1x20 min /day	5 days/week	4 weeks	7,2±1, 48	-
		MT + tDCS	1x20 min /day (MT) + 1x22 min /day (tDCS)	5 days/week	4 weeks	7,7±1, 49	-
		MT + sham tDCS	1x20 min /day (MT + 1x22 min /day (sham tDCS)	5 days/week	4 weeks	7,6±1, 51	-
6	Gunduz et al. (2021)	MT + tDCS	1x12-15 min /day (MT) + 1x20 min day (tDCS)	5 days/week	4 weeks	6,18	-
		MT + sham tDCS	1x12-15 min /day (MT) + 1x20 min /day (sham tDCS)	5 days/week	4 weeks	6,03	-
		Covered MT+ tDCS	1x12-15 min /day (Covered MT) + 1x20 min /day (tDCS)	5 days/week	4 weeks	6,28	-
		Covered MT+	12-15 min/day	5	4 weeks	5,89	-

MT= Mirror Therapy; TT= Tactile therapy; PME; Phantom motor execution ; tDCS= Transcranial Di-
rect Current Stimualtion

Table 6. Result Literature

No.	Author/ year	Article Title	Population and respondent s	Metode (Study design, Instrument, stati stic analysis, Intervention	Research result	Limitation
1	Finn et al./ 2017	A Randomize d, Controlled Trial of Mirror Therapy for Upper Extremity Phantom Limb Pain in Male Amputees	A total of 15 male patients with upper extremity amputations and still experiencing phantom pain at Walter Reed Army Medical Center (WRAMC) and Brooke Army Medical Center (BAMC).	Study design: 1. RCT Instrument: VAS Statistical analysis: paired t test Intervention: Participants were divided into 2 groups, namely the treatment group (9 people) given mirror therapy and the control group given closed mirror therapy (3 people) and mental visualization (3 people). Therapy is done 15 minutes for 5 days / week in 2 weeks.	1. The treatment group experienced a significant reduction in pain compared to the control group. In the treatment group, the initial average VAS score was 41.4 to 27.5. While in the control group there was no significant reduction in pain with the VAS score initially being an average of 35.2 to 48.5	The population of participants was only male, the sample size was too small so that it could not be grouped according to basic characteristi cs such as time since amputation,.
2	Ramadu gu et al./ 2017	Intervention for Phantom Limb Pain: A Randomize d Single Crossover Study of Mirror Therapy	Involved 64 adult patients experiencin g phantom pain after amputation at the Artificial Limb Centre	Study design: 1. randomized single crossover trial, single blind Instrument: VAS and Short form version of the McGill Pain Questionnaire. Statistical analysis: 2 unpaired t-test Intervention: Participants were divided into 2, namely the	1. At 4 th week the treatment group had a significant reduction in pain than the control group. The average VAS pain reduction score in the treatment group was 1.89 while in the control group it was 2.23. 2. The treatment group had a	Lack of participatin g female patients and no assessment of the patient's emotional status

3	Ol, et al./ 2018	Mirror Therapy for Phantom Limb and Stump Pain	45 adults with unilateral trans tibial amputation due to landmines and experiencing phantom pain in Cambodia.	<p>Study design: 1. randomized semi-crossover case control.</p> <p>Instruments: VAS</p> <p>Statistical analysis: ANOVA</p> <p>Intervention: This study used 3 groups, namely the mirror therapy group, the tactile group, and the combined group (mirror + tactile therapy). Each therapy was given for 5 minutes twice a day for 4 weeks.</p>	1. In the mirror therapy group, the mean initial VAS score was 6.7 to 1.6 after 4 weeks of treatment	Because the geographic area was narrow and the study patients were poor and hardworking farmers it minimized the significant influence of the physical variable, there were slight deviations from the trial protocol, and the reallocation of patients to the combined group was questionable.
4	Rothgan gel, et al. / 2018	Assesing the Traditional and Augmented Reality Mirror Therapy for Patients with Chronic Phantom Limb Pain (PACT Study): Results of a Three-group, Multicentre	This study was followed by 75 adult patients who had lower limb amputations	<p>Study design: single-blind randomized controlled trial.</p> <p>Instrument: NRS and the German version of the Neuropathic Pain Symptom Inventory</p> <p>Statistical analysis: Fisher's test and Mann Whitney test</p> <p>Intervention: This study will</p>	1. After 4 weeks, the average initial pain in the mirror therapy group was 5.7 to 4.2 after therapy	This In this study the calculated sample did not reach the size so it was underpowered and could explain why the study did not detect any significant effect. In addition, the sample was heterogeneous.

5	Segal et al./ 2020	Addictive Analgesic Effect of Transcranial Direct Current Stimulation Together with Mirror Therapy for Treatment of Phantom Pain.	Respondents: the total of respondents from the article is 359.	Study design: 1. After 3 months, it was found that the mirror therapy group + tDCS had a significant decrease in the mean score of 5.4±3.3 points than the mirror therapy group with a mean decrease of 1.2±1.1 points. And the mirror therapy group and false tDCS with an average value of 2.7±3.2 points Instrument : Short form of McGill Pain Questionnaire and Brief Pain Inventory Statistical analysis: one way ANOVA and RM ANOVA Intervention: patients were divided into 3 groups, namely the mirror therapy group + tDCS , the mirror therapy group, and the mirror therapy group + false tDCS. Treatment is carried out for 10 days for 2 weeks (excluding weekends)ctional	1. After 3 months, it was found that the mirror therapy group + tDCS had a significant decrease in the mean score of 5.4±3.3 points than the mirror therapy group with a mean decrease of 1.2±1.1 points. And the mirror therapy group and false tDCS with an average value of 2.7±3.2 points	Did not study the tDCS-only group so that the added value of combined treatment versus not could be performed, there were no data on which treatment was received so the quality of the blinds could not be assessed. The use of prostheses after amputation was also not noted, and limited patient heterogeneity.
6	Gunduz et al./ 2021	Effects of Combined and Alone Transcranial Motor Cortex Stimulation and Mirror Therapy in Phantom	A total of 112 patients experienced phantom pain and lower limb amputations	Study design: 1. There is no significant difference in PLP reduction between mirror therapy and closed mirror therapy with a beta coefficient Instruments: VAS Statistical Analysis: the hierarchical	1. There is no significant difference in PLP reduction between mirror therapy and closed mirror therapy with a beta coefficient	The sample only had a traumatic lower limb amputation so that it cannot be generalized to all

7	Zaheer et al./ 2021	Effects of Phantom Exercise on Pain, Mobility, and Quality of Life Among Lower Limb Amputees; A Randomized Controlled Trial	A total of 24 adult patients who experienced phantom pain and had lower extremity amputations	Study design: single blind randomized controlled Instrument: VAS Statistical analysis: RM ANOVA and unpaired t test Intervention: Patients were divided into 2 groups, namely the treatment group (n= 12 people) and the control group (n= 12 people). Both groups were given 15 minutes of mirror therapy and 20 minutes of physical therapy for 4 weeks. However, there is additional therapy, namely Phantom Motor Execution (PME) 15 minutes in the treatment group.	1. The VAS (pain) score in the treatment group was lower with p=0.003.	The rehabilitation center was closed due to the pandemic so it was difficult to collect data, the sample size was small so it was difficult to generalize the findings, there was no history of treatment, the location and cause of the amputation were not included.
8	Yildirim and Sen/ 2020	Mirror Therapy in the Management of Phantom Limb Pain	A 28-year-old woman who has amputated her right arm and is suffering from phantom pain	Study design: case report Instruments : NRS Intervention: Patients were trained in mirror therapy for 4 weeks. Then the patient will do self-mirror therapy at home every day for at least 20 minutes every day for 28	1. There was a decrease in the average pain score after therapy at week 2 the mean pain score was 1.15 points lower after therapy (score before 4.57 and after 3.42), at week 3 the mean pain score was 1, 57 points lower (score before	-

of the article, it was found that more men experienced phantom pain than women.

Incidence of Phantom Pain by Cause of Amputation

It turns out that from a collection of articles, it was found that the majority of people who experience phantom pain come from amputations caused by trauma (Finn et al., 2017; Ol et al., 2018; Rothgangel et al., 2018; Yildirim and Sen, 2020). Trauma that can cause amputation is a series of motor vehicle accidents, boating accidents, explosions from improvised explosive devices, and dynamite explosions (Finn et al., 2017). Amputations, especially those caused by trauma, can cause acute stress disorders or post-traumatic stress disorders (Maduri and Akhondi, 2021). Stress can trigger the emergence of phantom pain (Fuchs et al., 2018). Another similar study was conducted by Mallik et al. (2020), which states that 53.26% (49 people) who experience phantom pain have the cause of amputation trauma from traffic accidents. So it was found that the majority of people with phantom pain had amputations caused by trauma.

Procedure for doing Mirror Therapy

Mirror therapy was first reported by Ramachandran and Rogers aimed at relieving PLP (Phantom Limb Pain) in 1993 (Ramadugu et al., 2017; Yildirim and Sen, 2020). When doing mirror therapy, what needs to be prepared is a quiet place free from noise and a flat mirror that has a bottom base so that it can stand up when placed in various sizes (Ramadugu et al., 2017; Yildirim and Sen, 2020; Segal et al., 2021; Zaheer et al., 2021). Mirror therapy is initially performed by placing a parasagittal mirror in front of the patient's body so that the reflection will point to the part of the body that is not amputated (Zaheer et al., 2021). Furthermore, the healthy limb is placed in front of the mirror, and the amputated limb is placed behind the mirror so that it is not visible (Yildirim and Sen, 2020). After that, if the upper limb is amputated, the patient is asked to perform finger abduction/adduction, finger flexion/extension, hand pronation/supination, wrist flexion/extension, and hand flexion/extension while looking at the reflection in the mirror. Patients are asked to make slow movements so that the amputated limb also follows the drawing (Finn et al., 2017). The movement is repeated for the specified time.

Effect of Mirror Therapy on Phantom Pain

After being analyzed, it turned out that there were

five studies that showed a decrease in phantom pain before and after mirror therapy. Of the five articles, when viewed in terms of research design, there are four articles that use an RCT research design, and 1 uses a case report design (Finn et al., 2017; Ramadugu et al., 2017; Ol et al., 2018; Rothgangel et al., 2018; Yildirim and Sen, 2020). The RCT research design was used to see the effect of therapy so that the article was in accordance with the research objectives (Winardi and Musak, 2021). While the case report research design cannot be used for unique cases that are rarely encountered in the field (Barabara, 2020). When compared between case reports and RCT, the RCT study design is the most suitable for this study.

The effect of mirror therapy has various durations and frequencies, so the effects caused to reduce phantom pain vary. The duration and frequency of mirror therapy interventions to show pain relief ranged from 1 time for 10-30 minutes with a frequency of 2-5 days per week. (Finn et al., 2017; Ramadugu et al., 2017; Ol et al., 2018; Rothgangel et al., 2018; Yildirim and Sen, 2020). The effect of reducing phantom pain if mirror therapy is performed can be seen after two weeks with 15 minutes/day for five days/week. While the effect of mirror therapy to reduce pain with a maximum time of 16 weeks has a progressive decrease in pain until it shows no pain.

The explanation above shows a decrease in pain when mirror therapy is carried out. This is in accordance with the existing theory. Mirror therapy can reduce phantom pain because there are mechanisms associated with the occurrence of phantom pain. Phantom pain occurs when the brain is still sending signals to the amputated limb. However, the amputated limb is unable to send signals confirming that there is movement. Because it does not receive a signal, the brain will assume that the member is paralyzed, resulting in phantom pain (Finn et al., 2017). According to Ramadugu et al. (2018), Mirror therapy can work to reduce phantom pain because the image in the mirror will be substitute feedback for the amputated limb. The feedback will be sent to the brain. This causes the brain to receive movement signals from the amputated limb. The received signal will be sent to S1 (somatosensory cortex). The two hemispheres of the brain in the S1 (somatosensory cortex) will represent the same state, thus creating a normal state so that phantom pain will decrease.

Previous research that supports mirror therapy can reduce phantom pain is the study of Kulunkonglui et al. (2019). The study stated that there was a decrease

in phantom pain after mirror therapy for three months. This is evidenced by the initial median pain score of 70.5 to 0.0. The explanation above shows that it turns out that giving mirror therapy will have the effect of reducing phantom pain.

CONCLUSION

After being analyzed, it turned out that there was a decrease in pain before and mirror therapy interventions were carried out. Even with varying duration and frequency, mirror therapy can still reduce phantom pain. This shows that mirror therapy has the effect of reducing pain. Although it is proven that there is an effect of giving mirror therapy on reducing pain, that are only five articles that support it. The number of articles found is small. There haven't been many studies on mirror therapy for phantom pain, especially in Indonesia. Besides that, due to the diversity of respondents, it is not possible to know the relationship between the level of amputation and the incidence of phantom pain. The third, at the screening stage, is carried out by one person, so it is possible that there are good articles that are not selected. So it is necessary to do research with good quality such as RCT and need research with respondents who are evenly divided about the level of amputation so that can be found a relationship with the level of pain.

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