





Research

Art therapy to control nail biting using a cognitive behavioral approach through new innovative game and animation

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Abstract

Background Nail biting is categorized as a habitual behavior, commonly observed in children and occasionally in adults. This disorder occurs unconsciously, with individuals often unaware of their behavior. Since there are physical and psychological complications and quality of life problems in nail-biting, addressing this problem is very important and there are many theories in support of art therapy including: psychodynamic; humanistic (phenomenological, gestalt, person centered); psycho-educational (behavioral, cognitive behavioral, developmental); systemic (family and group therapy); as well as integrative and eclectic approaches. Art therapy, applied through various methods, serves as a strategy for habit modification. This study evaluates the impact of art therapy as a game and animation on controlling nail biting.

Methods The research was conducted as a single-group clinical trial, assessing participants before and after the intervention without a control group. The sample size was 14 participants, picked by the convenience technique. All students were referred to a counseling service center for nail-biting management. Seven girls and seven boys aged 9–12 participated in this study. Initially, the children were medically examined to confirm their physical well-being. Subsequently, assessments were made regarding parenting styles and anxiety levels, followed by baseline measurements and documentation of nail-biting frequency prior to the counseling intervention. Considering the importance of family support in empathizing with the child and the role of loneliness and anxiety in nail biting, two questionnaires (Goodenough's Draw-a-Man Test and Baumrind's Parenting Style Inventory) have been used for this study. A game and animation that increases self-awareness skills and reveals the cognitive error of the false pleasure of nail biting for the child, as well as alternative preventive behaviors are used in this study. Parents and children were then instructed as to how to use the new games and animations created for this purpose as part of the counseling sessions to address nail biting. The frequency of nail biting was monitored throughout the study, and finally, the data were subjected to a statistical analysis. It should be said that not having a control group in this research is one of the limitations of the study.

Results The results indicated a remarkable improvement in nail biting frequency following the introduction of the games, demonstrating a significant reduction in the behavior. The findings showed that the total number of times of nail biting in the group increased from 149 times a day at the beginning of the study to 20 times a day at the end of the intervention, and it actually shows an 86 percent decrease in the habit of nail biting in the group.

Conclusion Given the effectiveness of the art therapy intervention in curbing nail biting, it is recommended that future research be conducted as a controlled clinical trial with parallel groups and a larger sample. Additionally, at the beginning

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of studies related to art therapy and habitual behavioral disorders, it is better to measure children's life skills, including self-awareness, problem-solving skills, and creative thinking. Dealing with various tools and methods of art therapy in a comparative manner is another research need in the future because it provides a suitable structure for digital and internet-based services and finally artificial intelligence in this field.

Keywords Art therapy · Nail biting · Cognitive behavioral therapy · Digital health · Onychophagia · Body-focused repetitive behaviour disorder · Habit modification

1 Background

Nail-biting, which is commonly recognized as a prevalent disorder in pediatric populations [1], is a neurotic condition and a satisfying habit that garners attention in both dental and psychological fields [2]. However, it is not classified as a different disorder in the Diagnostic and Statistical Manual of Mental Disorders (DSM). Nonetheless, as a body-focused repetitive behavior, it is categorized as an instance of obsessive–compulsive disorder [3, 4]. Nail biting (NB), also called onychophagy, is a chronic condition sorted as a body-focused repetitive behaviour disorder; it is considered an obsessive–compulsive disorder in the Diagnostic and Statistical Manual of Mental Disorders [5], and is classified by the International Classification of Diseases 10 Revision (ICD-10) with the code F98.8. It is described as a voluntary, repetitive and nonfunctional movement that is not part of any recognized psychiatric or neurological condition [6]. Although the exact cause of nail biting is not well understood, anxiety is often associated with this condition [7, 8] and also nail-biting can be done consciously or unconsciously [9], but inheritance with a positive family history is effective [10], and some risk factors have also been introduced for it, such as Long-term breastfeeding [11] or nonnutritive activities, such as thumb and pacifier sucking [12] which is actually a pathological continuation of the breastfeeding process [2]. If nail biting is not treated, it can cause physical and psychological complications and quality of life problems [13] and a variety of issues, including intestinal infections and diarrhea, abnormalities in teeth and jaw structure, damage to internal organs, deterioration and loss of nails, and social difficulties for the patient [7, 14–21]. Both pharmacological and non-pharmacological interventions are recognized for treating nail-biting disorder [21]. Currently, habit reversal training, a cognitive-behavioral technique, is recognized as an effective treatment for individuals with this condition [22, 23]. Play therapy, along with cognitive behavioral therapy (CBT), is recommended as a treatment method for various mental and behavioral disorders [24]. The advent of new technologies has elevated the role of CBT in psychological treatments. Presently, the provision of CBT via the Internet is a prominent subject of discussion in the realm of behavioral disorder therapies [25, 26].

The role of art therapy in improving physical and mental health and well-being has been identified [27] and it is used in various fields of prevention and treatment for mental health [28]. Considering that in the study by Cohen and colleagues about how effectively art therapy can work, it was suggested that more studies should be done [29], and in this case, Zhang et al. showed that art therapy has a good power to solve the problem of children's anxiety [30].

Art therapy has been used in studies in various ways, including making crafts, games, coloring, painting, storytelling, role playing, and dancing [31–33]. Considering the importance of art therapy in both diagnosis and treatment, especially in children [34]. In addition to the effectiveness of art therapy, the conducted studies recommend that more studies be conducted in this field [35]. Although, online art therapy has been reported [36], there are few studies in this field, and considering the importance of online interventions and especially the emergence of artificial intelligence in this field, the need for more studies using different art therapy methods is quite noticeable.

This study uses animation to eliminate some factors affecting nail biting such as loneliness and anxiety through empathy and family support, as well as games to improve knowledge about the side effects of nail biting and to solve the problem of cognitive error related to the soothing effect of nail biting and the use of behaviors. It uses an alternative active like game and an emotional system of earning rewards by earning points in each game along with reducing the number of nail biting times.

2 Methods

For this study, the research group developed two new games based on cognitive-behavioral principles, accompanied by an animation, which received ethical approval as health education games aimed at health promotion from the Ardabil University of Medical Sciences Ethics Committee under the code IR.ARUMS.REC.1398.654 and were registered with the design code 3220. The procedure was explained to the parents, and the parents confirmed that their child was participating in the study. The research procedure was composed of the following steps:

1. The inclusion criteria included nail biting and not using treatment or other intervention and Exclusion criteria include lack of consent of the patient's parents to participate in the study or lack of consent at any stage of the intervention. Fourteen children experiencing nail-biting issues were chosen as a convenient sample for the study. After a thorough review of the medical and illness history, including examining each child's personal life history, no indications of a specific neurological disorder or any particular medical issue were found, as confirmed by the doctor's advice. Consequently, in the absence of any medical issues, the patient was scheduled for positive CBT combined with art therapy (play therapy). Informed consent was obtained from parent. For a period of ten days, data on the frequency of the child's nail-biting incidents were gathered from both school and family observations. Additionally, the circumstances in which the child was most likely to engage in nail-biting were documented. Also, these data were collected for ten days prior to treatment, throughout the treatment duration, and for ten days following the final counseling session from school and family reports. Likewise, the situations in which the child was most prone to engage in nail-biting were recorded.
2. A structured diagnostic interview for mental disorders was conducted to evaluate potential psychological issues related to nail biting [37].

The child's anxiety was assessed using Goodenough's Draw-a-Man Test, revised by Harris, which is a visual assessment instrument [38] Cronbach's alpha test for this questionnaire in Iranian children is reported to be 0.82. Goodenough's Draw-a-Man Test is used to identify the child's anxiety by allowing the child to draw several pictures using several pieces of paper and several colored pencils. The difference in the drawings and the crookedness of the lines and scribbles and many deletions in the drawing as well as the drawing of a worried face are symptoms of anxiety in the child. This test was used to evaluate the child herself, not to evaluate group anxiety, and it was used only to evaluate the case itself at the beginning of the study.

Baumrind's Parenting Style Inventory was also completed to evaluate the dynamics of parent-child communication [38] Cronbach's alpha test for this questionnaire in Iranian children is reported to be 0.81. Baumrind's parenting style questionnaire has 30 questions and in front of each question there are 5 options such as completely agree, agree, no opinion, disagree and completely disagree, which are scored from 0 to 4 respectively. The three axes of parenting are liberating, authoritarian, and authoritative, for each method, a separate score is obtained, and the method that gets the highest score is the parent's parenting method. This questionnaire was completed for each child at the beginning of the study for the parents and was used to collect additional information for the child, and the purpose of the test was not to test parenting methods in the experimental group.

3. The intervention program consisted of seven sessions, including a specialized animation designed to foster parent-child empathy and innovative game aimed at helping children manage nail biting. The consultant provided these elements during the intervention sessions.
4. Counting the number of nail biting times at school was done by the teacher and the class representative and at home by the parents (of course, one of the limitations of the study could be counting the number of nail -biting times), but the total number of times stated by the teacher and the class representative and the parents that was previously coordinated with them.
5. Finally, the treatment sessions were conducted as described in Table 1.

The intervention sessions were conducted at five-day intervals up to the sixth session. Records of the frequency of nail-biting were meticulously documented from the day following the sixth session for ten consecutive days. The frequency of nail biting before the initiation of the intervention, as the pre-intervention frequency, and its frequency recorded on the tenth day following the last session, as the post-intervention frequency, were subjected to statistical analysis. In the seventh session, conducted ten days subsequent to the sixth, the outcomes of the intervention and the strategies for managing nail-biting were reviewed with both the child and the parents. The significance of continued practice at home by both the child and the parents was underscored to help prevent the issue from reoccurring (Plate 1, 2, 3, 4).

In the animation produced, the atmosphere of the film is very happy and attractive for the child, and the conversation between the child and the parents is very warm and intimate. In this animation, the mother talks about the child's healthy nails about the fingers that have healthy nails and has a positive approach to the child's behavior and does not actually blame the child for biting his nails. This aspect of the animation has motivated the child to watch the animation many times, and in fact, it is a kind of non-verbal expression, in other words, the child's emotional expression about the existing problem and the child's desire to solve it.

Table 1 The positive CBT sessions with art therapy (based on play therapy and animation) to solve the nail biting issue

Session	Objective	Subject	Patient's homework
1	Collecting data for diagnosis	Filling out the positive nail-biting training questionnaire at the respective site	Recording the frequency of nail-biting for 10 days prior to intervention by the patient, as well as by the parents and caregivers if observed
2	Training the family and caregivers as to helping the treatment of the child's nail-biting with a positive approach and the situations in which nail biting starts	Watching the nail-biting motion graphic and understanding the patient's feelings about nail biting	Recording the frequency of nail-biting and the time and place of nail-biting. Role playing by the patient, like what Dara and Dara's mother did in the motion graphic, and emphasis on doing it by the parents. Explaining the patient's feelings about nail biting
3	Educating the patient to improve understanding of the nail biting process and its complications	Playing spiral and carousel games daily for a week, observing the points obtained by the patient, studying the nail-biting treatment book through the game, and rewarding the patient if she gets the desired results	Recording the frequency of nail-biting during the treatment and when and where it is undertaken. Playing the spiral game daily, using the electronic version of the nail biting book and the assignments in it, and answering the questionnaire at the end of the game session
4	Teaching alternative behaviors	Doing the tasks of the third session and alternative behaviors, e.g., holding a pen in hand and doing wrist exercises	Recording the frequency of nail-biting during the spiral game, practicing and performing alternative behaviors, drawing beautiful nail paintings, and answering the questionnaire
5	Relaxation training	Reviewing the previous session, training the child to calm down, and offering a likely reward to the patient based on the game points and the decrease in the rate of nail-biting	Implementing the relaxation method, recording the frequency of nail biting during the spiral game, practicing and performing alternative behaviors, drawing beautiful nail paintings and the side-effects of nail biting based on the nail biting treatment booklet through the game, and answering the questionnaire
6	Maintenance phase training	Summarizing activities and how family and relatives can provide support in the future	After the test, how the family can provide care and create a warm and stress-free environment for the child, advice to plan suitable sports activities for the child
7	Follow-up after ten days without consultant intervention	Revisiting the frequency of nail biting during ten days after the intervention	Presenting a new program based on the changes observed in the control results of nail biting by the consultant to the parents to maintain the maintenance phase of the intervention

A Plate 3 The spiral game to deal with nail biting. It reinforces the child's recognition of the nail biting disadvantages and the advantages of pretty nails, as well as positive behaviors in preserving the nails and their role in life. Points are given at each stage as the child progresses, leading to rewards at the end of the game.

Plate 1 The educational animation of nail biting



Plate 2 The electronic play therapy booklet for nail biting



Plate 3 The spiral game to deal with nail biting



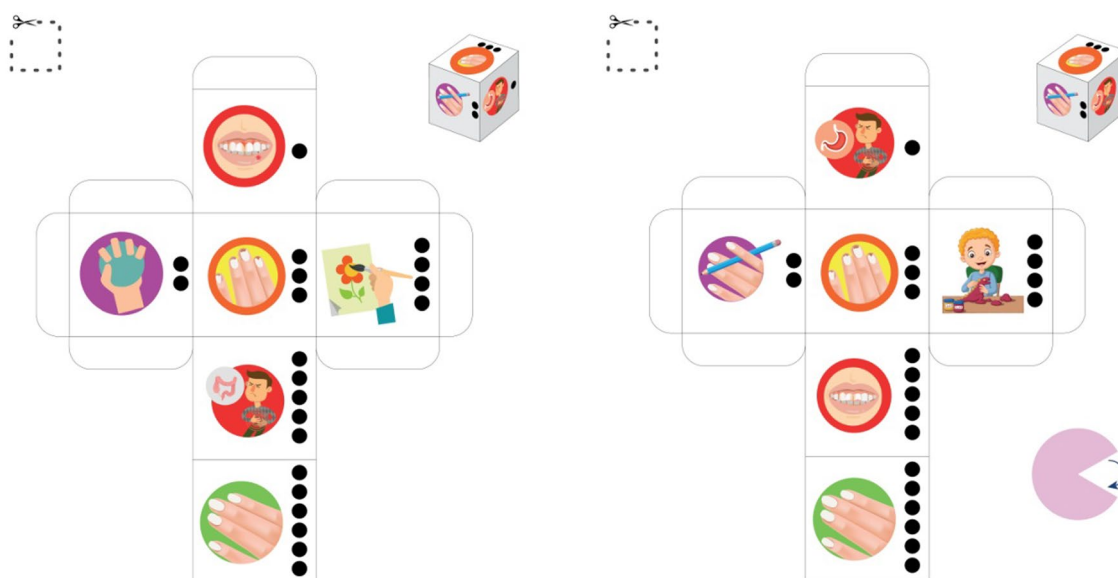


Plate 4 The dice and paper dead construction

How to play: The main path of the game is the path of health. The game starts by throwing the dice and seeing the number 6 (the same beautiful nail) and the child moves along the path with a paper bead.

Therefore, by throwing a cube-shaped dice that has beautiful nails and activities related to beautiful nails, he enters the green path and by throwing the dice in the next steps, he continues his way to the end of the path and receives the corresponding points. Pictures related to this path have special points to receive a prize at the end of the intervention program.

The orange path is actually signs and behaviors related to nail biting, and if the images related to this path are seen by throwing the dice, the child must continue this path in the game, and by continuing this path, he loses some of his points. The yellow path is the problem of nail biting, and if throwing the dice leads to seeing the images of this path, the child must still follow this path, which again loses part of his points. This game is played by two players.

It is necessary to explain that Both the game and the animation directly and indirectly improve the child's knowledge about the benefits of nails and the side effects of nail biting, and at the same time, the child is asked to use the introduced game every time he feels the need to bite his nails, and the success is rewarded. It was also done after observing the child's success without promising the child a reward.

3 Results

The children had an average age of 10.4 years, ranging from 9 to 12. The group was evenly divided, with half being girls and the other half boys. None had any known specific medical conditions, nor had any received prior consultation for nail biting management. Table 2 presents the pre-intervention frequency of nail biting, ranging from 9 to 12 times per day. Table 3 presents the post-intervention nail-biting frequency, which shows a significant decrease, ranging from zero to two times per day. The paired t-test on the pre- and post-intervention data indicates a statistically significant reduction in the frequency of nail-biting following the counseling sessions (Table 4).

An additional analytical method employed in this study to assess the effectiveness of art therapy-based intervention on nail biting is Blanchard and Schwarz's intervention progress and symptom reduction formula. At the onset of the art therapy consultation sessions, the study group exhibited nail biting behavior 149 times daily. By the program's conclusion, this frequency had diminished to 20 times per day, marking an 86% reduction in nail biting incidents within the group. Blanchard suggests that a symptom reduction exceeding 50% is indicative of a successful intervention; a decrease ranging from 25 to 49% is considered a moderate improvement, while a decrease below 25% is deemed unsuccessful [39].

Table 2 The pre-intervention frequency of nail biting

		Frequency	Percent	Valid percent	Cumulative percent
Valid	9	2	13.3	14.3	14.3
	10	5	33.3	35.7	50.0
	11	3	20.0	21.4	71.4
	12	4	26.7	28.6	100.0
	Total	14	93.3	100.0	
Missing	System	1	6.7		
Total		15	100.0		

Table 3 The post-intervention frequency of nail biting

		Frequency	Percent	Valid percent	Cumulative percent
Valid	0	2	13.3	14.3	14.3
	1	4	26.7	28.6	42.9
	2	8	53.3	57.1	100.0
	Total	14	93.3	100.0	
Missing	System	1	6.7		
Total		15	100.0		

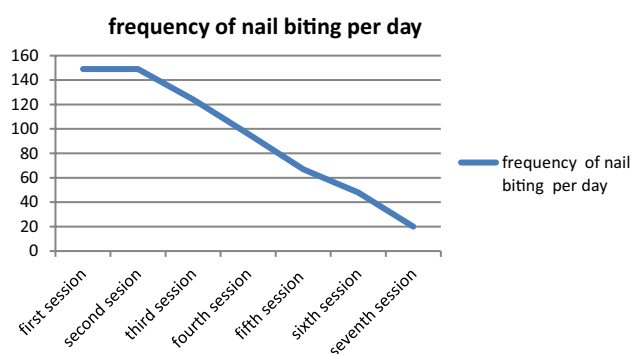
Table 4 The comparison of the pre-intervention and post-intervention frequency of nail biting

		Paired differences				t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error mean	95% confidence interval of the difference			
					Lower	Upper		
Pair 1	Pre-intervention– Post-intervention	9.21429	1.25137	0.33444	8.49176	9.93681	27.551 13	0.000

The process flow diagram, or control chart, serves as an effective instrument for ongoing monitoring of a phenomenon and analyzing a process. It has recently gained prominence in evaluating the enhancement of health skills and the advancement of interventions and care, whether at the individual or organizational level [40]. The flow diagram for the counseling process of nail biting management indicates that significant progress has been made throughout the course of the therapy sessions (Fig. 1).

Since the child starts the activities related to habit reversal treatment, the changes in reducing nail biting are quite evident, but it must be said that since we do not have a comparison group, the results of the intervention actually depend on the entire program and the activities included in it, and to determine the exact impact of each among the activities to improve the solution of the problem of nail biting, there is a need to select more sample size and more comparison groups by conducting intervention based on each specific activity.

Fig. 1 The consultation process flow diagram for nail biting management



4 Discussion

The results indicate that art therapy, combined with a cognitive-behavioral approach and facilitated through two novel games, can effectively contribute to controlling nail biting in children. By eating nails, the child thinks that there is pleasure in the work or that this action leads to his relaxation, while this is a type of cognitive error regarding the harmful behavior he has, and improving the child's knowledge about the complications of this work leads to the correction of this cognitive error. In relation to behavior, it should be said that watching movies at home, using the game introduced at home and at school, holding a pencil in hand and using deep breathing techniques when they feel the need to suck their finger are substitute behaviors that are well prepared in the animation in order to prevention of the harmful habits like that nail biting.

The feeling of false pleasure from nail biting and the desire to know its side effects and the desire to accept responsibility for solving the problem can be inferred from the child's desire to repeat the game. Engaging in the game is actually expressing the child's feelings and his excitement in the pleasure of knowing his problem and being ready to solve it. The desire of the child to watch the animation with the family is actually an expression of feeling more comfortable being with the family, and on the other hand, the desire to accept playing and repeating the game is a non-verbal expression of the problems that the child is familiar with while biting his nails and in other words expresses that the nail becoming ugly as a result of chewing it is a problem that he must solve this problem somehow. In this intervention, the process of enhancing excitement in the preparation program is followed by the child winning each game and collecting points to win the final prize.

Play therapy and animation within a cognitive-behavioral framework hold significant potential within healthcare systems for their therapeutic value [41, 42]. There is currently no standard treatment regarding nail biting as a detrimental habit, and both medicinal and non-medicinal approaches are employed [43]. The efficacy of CBT in treating habitual disorders has been documented in the literature [44, 45]. Evidence strongly supports behavioral therapy as the primary treatment modality for nail biting [46].

Behavioral therapy encompasses a range of techniques, including non-removable reminders, progressive muscle relaxation, self-help strategies, habit reversal, aversion therapy (which is not suggested because of technical and ethical considerations), competing response therapies, and positive reinforcement [47–50]. Recognizing the triggers of a habit and employing habit-inhibitory competing responses have proven effective in addressing issues related to undesirable habits [51, 52], as demonstrated in this study.

Addressing a deeply ingrained habit that has persisted over time requires more robust interventions to enhance understanding of the issue and reinforce positive behaviors. Play therapy creates an engaging, dynamic, and repetitive environment and can significantly lead to sustained behavioral change and prevent relapse by engaging multiple senses. Art therapy techniques, including music, crafts [53, 54], and physical activities [55], have been shown to be highly beneficial in this context. Baghchechi et al. [56] reported that children were assisted by visual educational material in learning mechanisms to cope with nailbiting. We also used animation to promote parents' emotional connection with children. Watching the animation of the child with the parents helps the intimate and warm relationship between the child and the parents and makes the role of family support and parenting more prominent.

The use of visual media, like videos, was also recommended by Moritz et al. [57] along with three hybrid methods for controlling nail-biting. In the present work, the media of animation and printed picture media were supplied to the children and parents as a game to promote their ability of nail-biting control, which contributed to the effectiveness

of the intervention. Another characteristic of the present work was empowerment for self-help. A similar case can be found in Moritz et al. [58], who showed that self-care and self-help played an essential role, among with the habit-replacement intervention, in controlling nail-biting.

This study, like other studies, has limitations. The low sample size, the lack of an independent comparison group, the short duration of the follow-up period of the intervention, the counting of the number of actual times of nail-biting outside the home, and the lack of a placebo are the limitations of the present study, which should be considered in future studies.

Suggestions for future research: Considering the future of artificial intelligence and the desire to use Internet-based interventions in counseling and mental health, it is suggested to use this method in other bad and harmful habits through internet or digital based method so that its results can provide a suitable mechanism for an effective Internet counseling.

5 Conclusions

This study concludes that art therapy, using a cognitive-behavioral approach and incorporating two innovative games, has successfully addressed nail-biting issues. Further clinical trials are recommended to validate this treatment method for broader application.

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Author contributions Author Contributions S.M.S and MS conceptualized the study, carried out the intervention and wrote and edited the manuscript. FD and S.M.S performed statistical analysis, data interpretation and editing of the manuscript. S.M.S and AA assisted with carrying out the intervention and data collection. NN and MS contributed to drafting the manuscript. KV and NN helped conceptualize the study, assisted with reviewing and interpreting the data analysis and editing the manuscript. All authors approved of the final manuscript.

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Data availability Data is provided within the manuscript or supplementary information files".

Code availability Not applicable.

Declarations

Ethics approval and consent to participate The study procedure was approved by the Ethics Committee of the the Ardabil University of Medicine sciences (No. R.ARUMS.REC.1398.654). The study was performed in accordance with all relevant guidelines and regulations. Participants were given information about their rights, study aims, and the confidential and anonymous use and preservation of data. Participation was voluntary and each participant provided written informed consent. The data were collected and stored confidentially, and the results were reported in a way that an individual participant is not identifiable.

Competing interests The authors declare no competing interests.

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