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Research paper

The potential of Freestyle Motocross (FMX) therapy as integrative medicine in pediatric oncology: A pre-post study design

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ABSTRACT

Introduction: Pediatric oncology integrative medicine is a growing field which needs further dedicated studies to expand the general awareness about the role of integrative therapies in mitigating the pediatric oncology experience. The present study intended to discover the potential of an innovative approach known as Freestyle Motocross Therapy (FMX Therapy) to support hospitalized pediatric cancer patients, their parents and doctor-nurse professionals. The specific aim was to explore if the quality of their oncology experience improved after FMX Therapy.

Method: This was a pre-post interventional study involving 50 pediatric patients with oncological disease (average age 9.2; 43 % male; 73 % leukemia diagnosis), 50 parents (average age 33.2; 83 % female) and 25 doctor-nurse professionals (95 % female).

The self-report questionnaire was completed by children/adolescents, parents and professionals before (Time 0) and after (Time 1) FMX Therapy, to assess several health outcome measures (e.g., pain, stress).

Results: After therapy, results showed a reduction in the average perception of pain in children/adolescents (Time 0 = 3.34 vs Time 1 = 1.66, $p < .0001$) and in the average perception of stress in parents (Time 0 = 6.92 vs Time 1 = 4.06, $p < .0001$). For both patients and parents, there was an increase in positive emotions and a reduction in negative emotions after FMX Therapy. Doctor-nurse professionals also highlighted the positive effects of FMX Therapy.

Conclusion: FMX Therapy improves the pediatric oncology experience, and it appears to have all the features to be considered a nascent field with great potential as integrative medicine for patients, parents and professionals.

1. Introduction

Children and adolescents with cancer, who have to follow chemotherapy treatments, often have to undergo long periods of treatment, are forced to stay in a hospital bed and experience feelings of both physical and emotional isolation. The disease and its treatments in patients cause real physical and emotional suffering, due both to the pain of the illness, and its psychological impact [1]; a consequence of their hospitalization which no longer allows them to carry out their routine everyday activities [2]. Parents also shoulder a substantial emotional and physical burden due to their child's symptoms [3]. Clinicians and all those who spend time in pediatric oncology wards observe that patients, despite the great suffering they have experienced, seek to be able to carry out activities when possible: to leave the room, to play, to do something, albeit briefly, that helps them maintain a connection with the outside world, which all gives them a sense of normality. The objective of the treatment is to aid in the restoration of good health of both children/adolescents and their parents, increasing their physical and psychological sense of wellbeing at an emotional and social level [4]. Therefore, the most effective therapy is based not only on specific medical treatments but also on a "holistic" approach to global care. In addition to the survival of the patients, their quality of life becomes a fundamental objective, both during and after treatment. For this reason, activities that reflect those that they might have done before their illness are considered very important [5]. Pediatric oncology is the branch of medicine that needs most of all, to assess its environment to provide patient-centered care that was reflected within the activities they arrange in hospital spaces. In recent years, increasingly, at specialized centers, very complex networks have been created around the sick child, formed not only of health workers, who provide the medical support but also by social workers, whose work all helps to create the most optimal conditions that respond to the mental and

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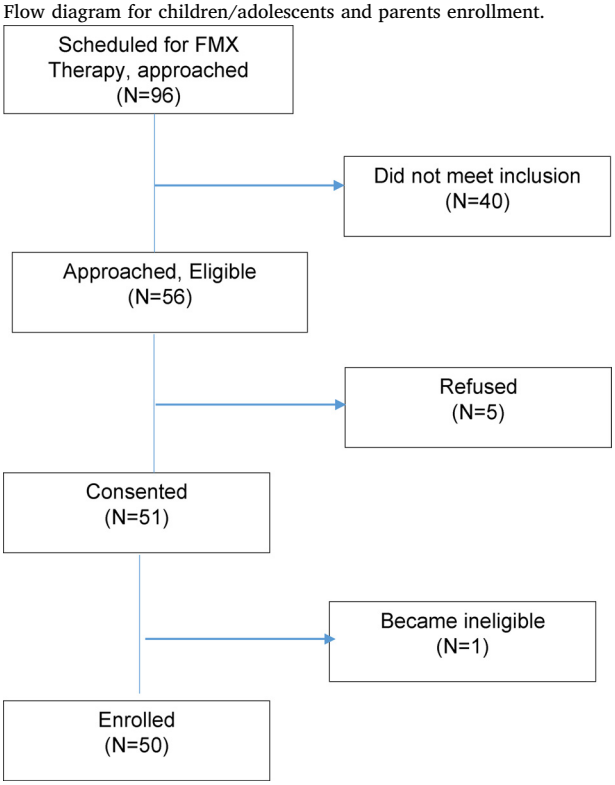
physical health needs of the patient and their parents. It is within this complex support network that complementary and alternative therapies find their place. These therapies have become more widespread in recent years, not only within the field of adult oncology but also in that of pediatric oncology. Furthermore, complementary and alternative therapies have been officially recognized for the first time in the United States by the National Center for Complementary and Alternative Medicine, a body that is part of the National Institute of Health. These complementary and alternative treatments, referred to as CAM (Complementary, Alternative Medicine) include a system of therapies and disciplines, which are classified in the National Center for Complementary and Alternative Medicine [6] as "the set of medical treatments, practical methods and of products that are not part of conventional medicine". Complementary care allows children and adolescents with cancer not lose sight of their uniqueness, to express emotions and moods, to activate useful resources and to feel like a "normal person" despite their illness. Many such activities have been successfully implemented in pediatric oncology departments which can be included in the CAM group. In many Italian pediatric oncology centers, in addition to specific spaces dedicated to educational and recreational activities, these are all the activities that help young patients feel that their lives are progressing as generally as possible. Some of the most common of these activities that have been introduced as complementary therapies and encourage creativity and relaxation include art therapy, Reiki and music therapy [7,8]. However, the literature shows that even more productive activities, such as sports, improve the global well-being of the individual. They induce the body to produce mood-enhancing endorphins. These dynamic activities are increasingly being considered a valid therapy for children or young people with oncological pathologies and also physical disabilities. Some studies have found that the benefits of sport activities include a significant reduction in stress levels, both for children/adolescents and their parents, and an overall improvement in the perception of one's physical health and body image, even for children with physical limitations [9] and with ongoing positive repercussions in terms of patient's general satisfaction and quality of life [10]. Also, a study has confirmed the health benefits for patients and successfully highlight the connection between the practice of these dynamic sports, and the improvement of health and general psychological well-being [11]. A type of active sports activities is the Freestyle Motocross (FMX) a recent variation of motocross. This sport does not focus on the speed but on the ability of riders to perform stunts during jumps. They perform in leaps of 45 m in height, reaching heights of about 18 m. In the present study, we would like to include the proposal for FMX activities in the hospital ward within the complementary interventions spectrum of alternative assistance, capable of acting positively in the short term on some physical feelings and emotions of children/adolescents and their parents. This therapy was named Freestyle Motocross Therapy (FMX Therapy). To our knowledge, no scientific studies have been conducted to evaluate the potential use of FMX activities as an integrative therapy for pediatric cancer patients. So, this study, for the first time intends to investigate the feasibility and efficacy of FMX Therapy as an adjunct to traditional care management for pediatric cancer patients during hospitalization, parents and doctor-nurse professionals.

2. Methods

2.1. Subjects

The subjects enrolled in the study were all patients currently hospitalized at the Pediatric Oncology ward of the Regina Margherita Children's Hospital in Turin, Italy. For each patient, we have also enrolled one parent. The ward accommodates 16 patients with their parents in single and private rooms. A written, information folder was delivered to patients and parents to explain what FMX Therapy is and how it is performed. Recruitment occurred from 1 January 2019 until 1 June 2019. The criteria for participation in the study were: the diagnosis of an onco-haematological pathology, an understanding of the Italian language, and obtaining the informed consent of parents or guardians and permission to participate in FMX Therapy actively. The criteria for the exclusion of patients were: patients who required isolation and/or who were affected by alert microorganisms which are potentially dangerous for other immunosuppressed patients; patients with platelet readings of < 20000 /mmc and Hb < 8.0 g/dl; age < 24 months. Of 96 patients/parents potentially enrolled, 50 patients/parents had eligible inclusion criteria (Flow Diagram Table 1). For the doctor-nurse professional's enrollment, we randomly selected a representative sample of professionals (e.g., head nurse, pediatric nurses and pediatric oncologists) who participated as observers in at least one of the sessions of FMX Therapy.

Table 1
Flow diagram for children/adolescents and parents enrollment.



2.2. Procedures

For this research, we used a pre-post study design, in which the aim was the change of some health outcomes after the FMX Therapy. A multidisciplinary team expert in pediatric oncology wrote the protocol for the study; the AOU City of Health and Science of Turin Ethics Committee Protocol 0016074 of 12/02/2019 approved it with also a specific authorization for FMX Therapy provided by the hospital legal representative. The main psychologist of the ward collected children/adolescents and parents' health outcomes (e.g., pain; stress; emotions and sensations) through a self-report questionnaire administered before (Time 0: 14 p.m.) and after (Time 1: 18 p.m.) each session of FMX Therapy (from 3 p.m. to 5 p.m.). The psychologist conducted a semi-structured interview with doctor-nurse professionals after FMX Therapy. Data obtained were then inserted and analyze in terms of mean values in an Excel data set. T-tests for the dependent sample were performed to verify the differences between pre and post values statistically.

2.3. Intervention

FMX Therapy consisted of sports sessions during which patients, together with an FMX expert, rode a motorbike around the ward performing in front of parents and professionals. Motorcycles were electric and all adequately disinfected. Six monthly FMX Therapy sessions (January 2019 - June 2019) were proposed. Each session included FMX Therapy activities conducted by four FMX experts who involved the patients for 2 h on the ward. Sessions were always organized for the same hour, and they consist of two big motorcycles and two mini-motorcycles which entered the ward. At first, the motorcyclists performed some acrobatics along the ward in front of the rooms. At that time, patients were invited to ride both big and small motorcycles together with motorcyclists. They spent two hours in the ward, during this time parents and doctor-nurse professionals observed the exhibition. One hour before and after the session, psychologist administered the questionnaire to the patient, parents and doctor-nurse professionals encouraging them to speak about their emotions and sensations.

2.4. Children/Adolescents health outcome measures

2.4.1. Perception of pain

The two visual analogue scales for pain were distributed according to age and aimed at investigating the intensity of the pain perceived by each patient, in the last few days of therapy, on a scale from 0 to 10. The Wong-Baker FACES SCALE (© 1983 Wong-Baker FACES Foundation. www.WongBakerFACES.org) was administered to children under four years of age. For children over the age of 4, the visual analogue scale VAS (Visual Analogue Scale (VAS) [12,13] was administered. VAS is the visual representation of the extent of pain that the patient subjectively feels. It is represented by a 10 cm long line in the original validated version, with or without notches at each centimeter. One end indicates the absence of pain and corresponds to 0; the other purpose indicates the worst pain imaginable and corresponds to 10. The scale is compiled manually by the patient who was asked to trace a mark on the line that represents the extent of their perceived pain. The distance measured from the end 0 corresponds to the subjective measure of pain. It was estimated at Time 0 (pre-FMX Therapy) and at Time 1 (post-FMX Therapy).

2.4.2. Emotions & sensations

In addition to pain, the emotions and sensations that children/adolescents experienced were investigated in their intensity. The feelings, presented on an ascending scale from 0 to 10, were: sadness, fear, relief, happiness and fun. They were measured at Time 0 (pre-FMX Therapy) and at Time 1 (post-FMX Therapy).

2.4.3. Autonomy & self-efficacy

The children/adolescents perception of autonomy and self-efficacy was investigated through 2 questions *(Am I able to do activities by myself? How much do I feel strong?*) in a three-point Likert scale: 1 = "Not at all"; 2 = "Enough"; 3 = "A lot". They were measured at Time 0 (pre-FMX Therapy) and at Time 1 (post-FMX Therapy).

2.5. Parents health outcome measures

2.5.1. Stress levels

The perceived stress levels of parents on a scale from 0 to 10, using the Numerical Rating Scale (NRS) was also examined [14]. This is a quantitative one-dimensional, numerical, 10-point scale of pain assessment. The scale requires you to select the number that best describes your intensity of stress, from 0 (no stress) to 10 (the worst possible stress), at that precise moment. This scale is administered at Time 0 (pre-FMX Therapy) and at Time 1 (post-FMX Therapy).

2.5.2. Emotions & sensations

In addition to stress, the emotions and sensations that parents' experienced their intensity was investigated. The emotions, presented on an ascending scale from 0 to 10, were: sadness, fear, relief, happiness and fun. They were measured at Time 0 (pre-FMX Therapy) and at Time 1 (post-FMX Therapy).

2.6. Doctor-nurse professionals health outcome measures

2.6.1. Perception of effects of FMX therapy

A semi-structured interview was administered to doctors and nurses about: the impact of FMX Therapy on children/adolescents and parents by also testing the intensity of these effects on a scale from 0 to 10 (*In your opinion, what are the effects of FMX Therapy on patients and parents?; What is the intensity of these effects on a scale from 0 (not at all effective) to 10 (totally effective)?; In your opinion, what are the effects of FMX Therapy on doctor-nursing professionals?; What is the intensity of these effects on a scale from 0 (not at all effective) to 10 (totally effective)?)*.

3. Results

This study involved 50 children/adolescents, 50 parents and 25 professionals (Table 2). Among doctor-nurse professionals, 2 head nurses, 7 nurses and 16 doctors were present on the day of the FMX Therapy sessions and participated in completing the interview. *t*-Test analyses were presented in Table 3.

3.1. Children/Adolescents

The results of the analysis of the self-report questionnaires administered to children/adolescents, before and after the FMX Therapy sessions, showed a reduction in the average perception of pain felt (T0 = 3.24 *vs* T1 = 1.66, $p < .0001$) (Fig. 1).

Within the intensity of the emotions experienced by the children/adolescents, there is an average increase in their positive emotions (happiness: T0 = 5.52 *vs* T1 = 7.74, $p < .0001$; fun T0 = 5.28 *vs* T1 = 8.28, $p < .0001$; relief: T0 = 4.85 *vs* T1 = 5.59, $p > 0.5$) (Fig. 2), and an average reduction in their negative emotions (sadness: T0 = 3.76 *vs* T1 = 2.2, $p < .0001$; fear T0 = 3.34 *vs* T1 = 2.46, $p < .05$) (Fig. 3).

In terms of children/adolescent perception of own autonomy, it emerged that at Time 1 it increased slightly (T0 = 2.14 *vs* T1 = 2.4, $p > 0.5$). The same is also true in their perception of own self-efficacy (T0 = 2.4 *vs* T1 = 2.5, $p > 0.5$) (Fig. 4).

3.2. Parents

From the administration of the questionnaires to parents the data

Table 2
Participant characteristics.

Children/Adolescents (N = 50)	
Gender	43 % Male
Mean age	9.2
Diagnosis	72 % Leukemia
	12 % Bone Tumor
	11 % Lymphoma
	5% CNS Tumor
Parents (N = 50)	
Gender	83 % Female
Mean age	33. 2
Doctor-nurse professionals (N = 25)	
Gender	95 % Female
Mean age	35.6
Average years of work	7.3

Table 3
T test among pre-post groups.

	Pre-test mean T0	*Post-test mean* T1	*t-test value*
Children/Adolescents			
Pain	3.24	1.66	−5.762***
Happiness	5.52	7.74	6.025***
Fun	5.28	8.28	6.984***
Relief	4.85	5.59	1.323
Sadness	3.76	2.2	−4.185***
Fear	3.34	2.46	−2.225*
Autonomy	2.14	2.4	1.519
Self-efficacy	2.4	2.5	1.520
Parents			
Stress	6.92	4.06	−7.261***
Happiness	4.46	7.22	6.504***
Fun	3.9	7.94	7.591***
Relief	5.32	6.74	3.928*
Sadness	6.72	3.06	−10.473***
Fear	6.68	3.26	−7.139***

* $p < .05$.
*** $p < .0001$.

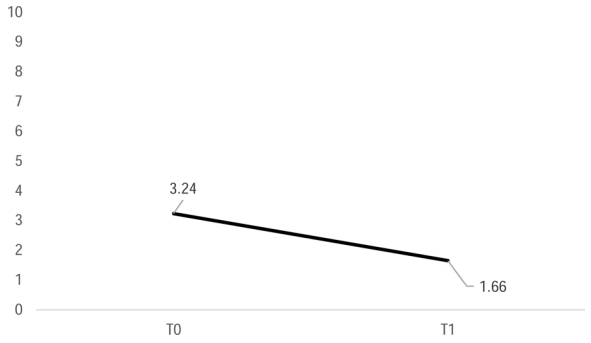


Fig. 1. Children/adolescents pain intensity before (T0) and after (T1) FMX Therapy.

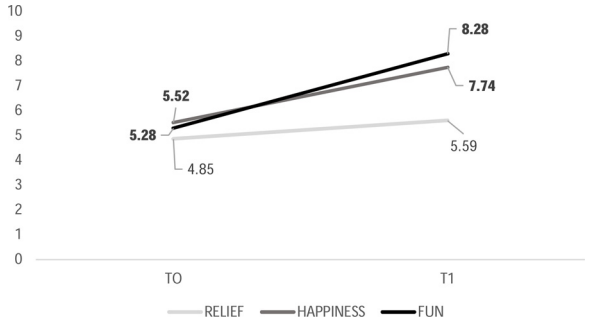


Fig. 2. Children/adolescents positive emotions intensity before (T0) and after (T1) FMX Therapy.

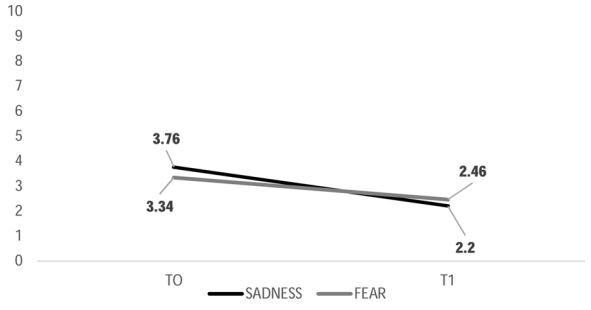


Fig. 3. Children/adolescents negative emotions intensity before (T0) and after (T1) FMX Therapy.

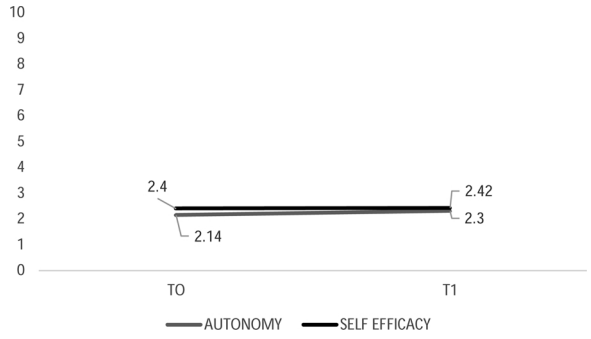


Fig. 4. Children/adolescents autonomy and self-efficacy before (T0) and after (T1) FMX Therapy.

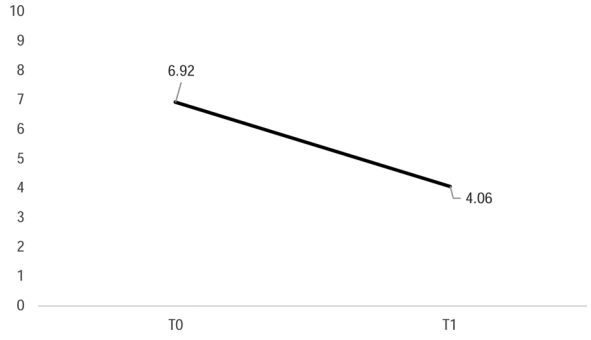


Fig. 5. Parents stress intensity before (T0) and after (T1) FMX Therapy.

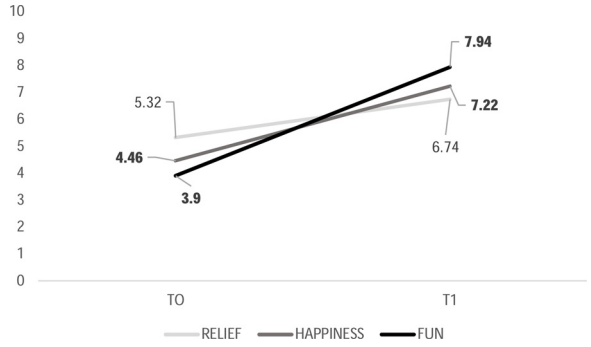


Fig. 6. Parents positive emotions intensity before (T0) and after (T1) FMX Therapy.

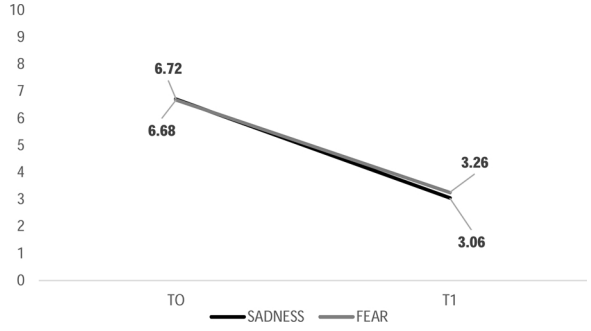


Fig. 7. Parents negative emotions intensity before (T0) and after (T1) FMX Therapy.

shows that at Time 1 there was an average reduction in stress (T0 = 6.92 *vs* T1 = 4.06, $p < .0001$) (Fig. 5) with an average increase in their positive emotions (happiness: T0 = 4.46 *vs* T1 = 7.22, $p < .0001$; fun: T0 = 3.9 *vs* T1 = 7.94, $p < .0001$; relief: TO = 5.32 *vs* T1 = 6.74, $p < .05$) (Fig. 6) and an average reduction in their

negative emotions (sadness: T0 = 6.72 *vs* T1 = 3.06, p < .0001; fear: T0 = 6.68 *vs* T1 = 3.26, p < .0001) (Fig. 7).

3.3. Doctor-nurse professionals

From the semi-structured interview administered to doctor-nurse professionals, the emotions most detected by professionals are joy and wonder. The level of intensity of these effects perceived by doctor-nurse professionals is 8 on average (on a scale of 0–10).

4. Discussion

This study revealed interesting results in terms of the beneficial effects of FMX Therapy. Following the six-monthly sessions proposed for the Pediatric Oncology ward of the Regina Margherita Children's Hospital in Turin, it was observed that these activities had positive consequences for patients, parents and doctor-nurse professionals. For scientific literature, these results are particularly interesting also because they are supported by robust analysis, which indicates that there is indeed a benefit in the comparison between pre (Time 0) and post (Time 1) FMX therapy. So, the effectiveness of this new integrative medicine is confirmed.

The data shows a reduction in the pain perceived by children/adolescents and an increase in positive emotions, in particular concerning happiness and fun.

The reduction of sadness is also an interesting result, as it represents one of the main emotions that patients experience because of hospitalization. Children/adolescents often appear bored and sad due to the many days spent in their room while undergoing treatment.

Even for parents, there is a reduction in stress. This is a significant result as undue stress risks affecting negatively on children in their care. The chance for the patients and parents to have a positive experience within the ward is also significant. Being able to see their children happy and entertained, despite the difficulties of the illness, arguably makes them feel happier and more content.

For both patients and parents, however, the emotions that not improve significantly is the relief, probably because it is a general construct very difficult to explain and make patients understand.

The increase of autonomy and self-efficacy in patients after FMX Therapy is not a result statistically significant. This is probably because children and adolescents during hospitalization are bound to the medical therapies and healthcare rules, and therefore their age-typical experimentation activities are limited. They were also forced to be always with an adult from which they depend because of their clinical conditions and physical limitations (e.g., immunosuppression; central venous catheter).

So, all these aspects undoubtedly hinder the construction of autonomy and the perception of self-efficacy making even more difficult to achieve these development tasks, despite the proposal of FMX Therapy. However, in our opinion, FMX Therapy aims to empower these constructs, since that favor unusual, adrenaline-fueled and dynamic experiences which make patients feel stronger and more able-bodied. Future studies could examine if FMX Therapy can empower children/adolescents autonomy in particular for patients who present physical limitations by allowing them to experience strong emotions and sensations and increase their sense of self-efficacy. Some studies underline a relationship between physical activity and quality of life in an amputee population [15] also supporting and promoting social interaction.

It would be interesting to be able to evaluate this relationship also in cancer pediatric populations. Also, this type of integrative medicine can favor the adaptation to the hospital environment, by making patients less fearful and more involved in the context of the care environment, so that the experience of hospitalization can be remembered more fondly and integrated into the recovery and growth process. During the FMX Therapy sessions, the hospital becomes a place of leisure, fun and experimentation with new experiences that young patients have on their own, without having to depend on their parents, as is the norm during their hospitalization.

This experience also has a positive impact on the patients' parents by offering them opportunities for indirect support.

Doctor-nurse professionals also underline that FMX Therapy is a novelty that builds curiosity in children/adolescents and their parents. It is an activity that demands participation and helps parents and patients detach themselves from the routine of hospitalization, allowing them to experience something they wouldn't usually experience.

This study has some limitations that must be highlighted for the advancement of studies about FMX Therapy: the problem of non-normative sample among children with specific disease is well known, and our sample size is adequate by contributing to significant results. However, these results must be confirmed by further studies with a larger sample of patients, possibly belonging to different centers to be able to assign subjects to treatment and control groups randomly. Since from an ethical point of view, it is not possible to have a group to which the intervention was not proposed, future studies could use the intervention group as control of itself. Also, a larger sample could offer the possibility of comparing patients' pain by taking into account some clinical variables (e.g., type of diagnosis).

On the other hand, this study has its merits. This is the first pilot study that verified the effects of FMX Therapy on pain of pediatric cancer hospitalized patients revealing that it is an acceptable and feasible therapy that can be used with sound effects to decrease pain especially during the inpatient period of oncology treatment. It is useful in the immediate reduction of pain and probably its benefits last for many hours. In addition to pharmacological pain management, FMX Therapy can be an effective, non-intrusive and complete strategy for the pain relief of children who are cancer patients. However, other studies could explore the effect of FMX Therapy on pharmacological pain medications use (e.g., narcotic) among cancer children both in terms of rate and drug intensity. Moreover, this study explores possible effects also on parents and doctor-nurse professionals: parents and professionals were daily exposed to suffering.

As recently highlighted by Raghunathan [16], some efforts should be made to involve both patients and parents in these studies. Pediatric oncology care teams, including oncologists, nurse practitioners, and social workers, should be educated about the variety of integrative therapies that can help mitigate treatment-related symptoms. Through better understanding, we can increase awareness about these modalities to improve the experience of pediatric cancer patients and their parents.

5. Conclusion

In conclusion, the data shows that, in the short term, FMX Therapy promotes the general well-being of patients and their parents by promoting and preserving their quality of life. Therefore, thanks to the results obtained, this activity, which promotes the use of a "holistic" approach in the treatment process, can be considered a valid complementary therapy in the treatment process. A key objective for future research would be to expand this project by involving other Italian pediatric oncology departments belonging to the Italian Association of Pediatric Hematology and Oncology (AIEOP).

However, as reported by Siegert and colleagues [17], the attendance of medical staff is advised at all time during FMX activities.

Author's contribution

All authors have contributed equally at manuscript drafting in terms of: rationale, methodology and procedure, data collection, statistical results.

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The research did not have any financing.

Declaration of Competing Interest

All authors declare no conflicts of interest. Allianz UMANA MENTE Foundation has supported FMX Therapy activities by facilitating contacts with motorcyclists and the organization of the events.

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