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ORIGINAL RESEARCH

Integrated Care Planning to Improve Outcomes in Pediatric Laser Treatment of Large Facial and Cervical Birthmarks

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Purpose: Children with facial and cervical birthmarks display unique physical and psychological complexities that demand multi-faceted, long-term care following laser treatment. Integrated care based on the integrated care models is a promising approach to address these needs. This study aimed to assess the efficacy of integrated care for children with large facial and cervical birthmarks who were undergoing laser treatment.

Patients and Methods: This retrospective study analyzed clinical data of children who received laser treatment under general anesthesia at our clinic from March 2022 to August 2024. Children were divided into a control group, which received conventional care, and a study group, which received integrated care based on the integrated care models in addition to conventional care. Outcomes compared between the groups included the children's FPS-R and medication awareness rates on the seventh day post-discharge, parental satisfaction at seven days and three months, and the incidence of adverse reactions within three months.

Results: A total of 153 children were enrolled in the study, with 76 in the study group and 77 in the control group. Under the premise of comparable clinical characteristics, the study group exhibited significantly lower FPS-R (P=0.012) on the seventh day and higher parental satisfaction at both seven days and three months post-discharge (P<0.001) compared to the control group. There was no significant difference in parental medication awareness rates between the groups, despite the study group achieving 100%. No significant differences were observed in the rates of adverse reactions; however, the control group reported severe local or systemic reactions, whereas the study group experienced only transient, mild adverse reactions.

Conclusion: This study provided the first evidence of the efficacy of integrated care in laser treatment for pediatric facial and cervical birthmarks, particularly in alleviating pain levels and enhancing parental satisfaction. It also mitigated the severity of post-discharge adverse reactions. Integrated care improves treatment outcomes and the care experience for families of these special children, warranting further investigation.

Keywords: integrated care, integrated care models, laser therapy, pediatric care, facial birthmarks, cervical birthmarks, parental satisfaction

Introduction

Birthmarks are common pediatric skin conditions and are of significant concern to children and their families. These conditions can be divided into three groups: pigmented birthmarks, vascular birthmarks, and birthmarks resulting from abnormal development.[1] Although most birthmarks are benign, those occurring on the face and neck can severely affect children's appearance, leading to feelings of inferiority and impairments in psychosocial health.[2,3] This results in anxiety in both children and their parents, adversely impacting their quality of life and prompting them to seek treatment.[4,5]

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Currently, the treatment for benign birthmarks is primarily outpatient laser therapy, including the use of CO_2 lasers, pulsed dye lasers, and Q-switched ruby, alexandrite, or Nd: YAG lasers.[6] Based on the selective photo-thermolysis and photoacoustic effects, laser therapy offers various advantages of convenience and minimal invasiveness compared to surgical therapy. However, it requires multiple sessions over several years,[7] with each session necessitating meticulous and persevering post-treatment care of the skin to ensure treatment efficacy and reduce the risk of infection and scarring, making nursing care indispensable in the entire treatment course.[8,9]

Furthermore, the pain associated with laser treatment of birthmarks, the lengthy skin recovery period following each session, the prolonged treatment course, and the potential for disfiguring adverse reactions can provoke severe depression and anxiety in both children and their parents. While laser treatments can be performed under local anesthesia, children often require general anesthesia due to their young age and inability to cooperate, which adds further complexity to care.[6] Conventional nursing care is inadequate for meeting the long-term, special care needs of these children. Thus, more personalized, appropriate, and effective care strategies are crucial.

Integrated care refers to a patient-centered approach that coordinates medical treatment, nursing support, and psychosocial services to ensure continuity across the perioperative and recovery phases. It emphasizes communication among healthcare providers, patients, and families to optimize outcomes and quality of life.[10] Within this framework, the integrated care model provides a structured process involving systematic assessment, individualized goal-setting, targeted interventions, and continuous evaluation. This model has been successfully applied in pediatric burn management and oncology nursing, where it has improved pain control, adherence to follow-up, and caregiver satisfaction.[11–13] Integrated care models featuring structured nursing and multidisciplinary coordination have been shown to improve outcomes in several pediatric specialties. In pediatric oncology, nonpharmacological interventions delivered through integrated nursing care have effectively reduced procedural pain and enhanced comfort and satisfaction in children undergoing treatment.[14] Within pediatric burn care, a transdisciplinary, family-centered rehabilitation team composed of clinicians, therapists, and psychosocial support staff has been associated with better pain control, psychological support, and functional recovery.[15,16] In dermatologic practice, integrated care pathways such as co-located models combining primary care providers and dermatologists have significantly shortened diagnosis-to-treatment intervals and improved patient and provider satisfaction.[17,18]

Integrated, people-centered care represents a contemporary trend in health services. According to the World Health Organization (WHO), integrated care can be categorized into different models based on its applicability to individuals, groups, and populations. The individual-focused integrated care models aim at delivering more personalized and targeted care by creating detailed care plans, which can clearly articulate the role of each provider in the care process and maintain both retrospective and prospective information for a particular patient.[19] Several studies have confirmed the efficacy of integrated care based on the integrated care models for children with special health and care needs, showing improvements in their health and rehabilitation, as well as increased satisfaction and well-being among both children and their parents.[20]

However, the nursing care for pediatric skin birthmarks treated with lasers presents its own particularities and complexities, and to date, there has been no literature specifically focusing on this area. In this retrospective study, we evaluate the efficacy of integrated care using the integrated care models for children undergoing laser treatment of large benign birthmarks on the face and neck under general anesthesia.

Materials and Methods

Study Design and Study Population

This was a retrospective study that involved children who underwent laser treatment for large facial and cervical birthmarks under general anesthesia at our dermatological laser center from March 2022 to August 2024. The data were retrieved from the medical records of the patients, and the efficacy of integrated care was evaluated. The aspects, including pain levels, parental medication awareness and satisfaction, and the incidence of adverse reactions, were assessed to provide practical experience into nursing care and integrated care in this specialized field.

Inclusion and Exclusion Criteria

Inclusion Criteria: (1) Age range: 3–14 years. (2) Types of skin birthmarks included: pigmented birthmarks (eg, congenital melanocytic nevi, nevus of Ota/dermal melanocytosis, café-au-lait macules), vascular birthmarks (eg, port-wine stains, infantile hemangiomas), and birthmarks due to developmental anomalies (eg, verrucous epidermal nevi). (3) Location of the skin birthmarks: facial and cervical regions, with a size exceeding 10cm × 10cm. (4) Availability of complete clinical data.

Exclusion Criteria: (1) Presence of severe conditions such as significant cardiac diseases, liver or kidney dysfunction, or psychiatric disorders. (2) Long-term use of medications that could affect pain perception, such as analgesics or sedatives. (3) Cognitive or communication impairments that could impede active participation in treatment and care.

Population Groups

Children were divided into a control group and a study group based on different nursing interventions. Two types of nursing care approaches were implemented in the healthcare setting. The control group received conventional nursing care, while the study group received three-month nursing care utilizing an integrated care approach based on the integrated care models in addition to conventional care.

Laser Devices

Depending on lesion characteristics, laser treatments were performed using three types of devices: Q-switched laser, dye laser, and CO_2 laser. Q-switched laser (commonly Nd: YAG, 1064 nm): fluence 5–7 J/cm², pulse width <10 ns, spot size 2–4 mm, with 2–3 passes depending on lesion depth. Dye laser (commonly pulsed dye laser, 585–595 nm): fluence 6–8 J/cm², pulse width 0.45–1.5 ms, spot size 7–10 mm, typically 1–2 passes. CO_2 laser (10,600 nm): power 2–5 W, continuous or super-pulsed mode, spot size 0.2–1 mm, 1–2 passes as tolerated.

Conventional Nursing Care

The conventional care includes a series of procedures to ensure the safety and efficacy of the laser treatment session. Before treatment, the nursing care focused on monitoring vital signs and assessing the health condition of a child to ensure suitability for treatment. Comprehensive education was also provided to the child and their parents about birthmarks and the treatment process.

The preparation phase involved sterilization of the treatment room, readiness of therapeutic and emergency supplies, and adjustment of room temperature and lighting to optimize the child's comfort. Post-treatment care included assistance to children during recovery from anesthesia and provision of appropriate support for pain and discomfort at the treatment site.

Integrated Care Based on the Integrated Care Models

The integrated care was implemented by the pediatric nurse in coordination with attending dermatologists. Pre-treatment care was provided mainly by nurses, dermatologists and pediatricians, while post-treatment involved interventions from anesthesiologists, psychologists, and dietitians who assisted in anesthesia recovery, provided personalized psychological care and advised on dietary/lifestyle changes respectively.

(1) Formation of a multidisciplinary medical and nursing team: The integrated care includes the formation of a multidisciplinary medical and nursing team, including healthcare personnel from pediatrics, anesthesiology, dermatology, psychiatry and dietetics. The multidisciplinary team received training to ensure the provision of high-quality care.

(2) Establishment of electronic health records: An electronic health database for all children was created, which was accessible to all team members and maintained for long-term use. Each record included entries on the child's basic demographic and medical information, treatment details, post-treatment medication, wound recovery status, and familial and psychological conditions.

(3) Creation of care plans. The care plan included a detailed consultation with each child and their parents to understand their specific needs and psychological conditions.

(4) Personalized health education: Personalized health education was provided to each child and their parents by using language and visuals specifically chosen to meet their needs. Supportive images and multimedia resources were also used to provide clear explanations.

(5) Personalized psychological care: Before treatment, puppets and toys were placed in the waiting room to create a comfortable environment for children and to relieve their feelings of fear and agitation. Following treatment, cartoon-themed electric fans were prepared to soothe symptoms of burning and pain in the wound. Distraction techniques such as cartoons and music were also used to divert the child's attention and diminish negative feelings. A one-on-one discussion with parents detailed the safety and efficacy of laser treatments and anesthesia, helping to ease their anxieties and concerns.

(6) Multimedia recovery guidance: The guidance about medication uses and their effects was provided through verbal communication, images, and video. Dietary guidance was also provided to ensure balanced nutrition and regular meals for the child. Lifestyle advice included ways of protecting the wound site, avoiding scratching, sun exposure, and washing the wound. These measures aimed to prevent adverse reactions such as scarring, pigmentation, and infection.

(7) Remote continuity and coordination of care: A dedicated care coordinator was assigned to each child and their family. After discharge, follow-ups were conducted on the first, third, and seventh days, and biweekly thereafter for up to three months, through telephone calls and WeChat (a smartphone chat app). Each follow-up session involved verbal communication to monitor wound recovery and the use of images and videos for personalized guidance. The psychological well-being of the child and their parents was also monitored, and counseling was provided to address feelings of inferiority, shame, and psychosocial impairments.

(8) Systematic tracking and adjustments: Systematic monitoring of the child's medical condition and recovery was conducted. Any issues identified during follow-ups were addressed by the child's care coordinator. Each coordinator facilitated discussions with the multidisciplinary medical team to ensure prompt interventions and adjustments to the care plan. The child and their parents were encouraged to attend regular follow-up appointments, with advance notification of the scheduling for these visits.

Observational Parameters

Pain Assessment

Pain assessment was conducted on the seventh day following discharge through a video call with the child and their parents by using the revised Wong-Baker Faces Pain Scale (FPS-R). The FPS-R is a widely used tool for assessment of pain levels in children aged three and older. This scale utilizes facial expressions corresponding to numerical scores ranging from 0 to 10, where 0 represents no pain or a pleasant expression, and 10 indicates extreme pain.[21] The scale was administered by trained nursing staff in the child's native language immediately after treatment and during follow-up visits. For younger children who required assistance, parents were guided to help interpret the child's responses without influencing their choice. The scale was translated into the local language using a forward–backward translation method, and it was pilot-tested among 10 parents to ensure clarity and cultural appropriateness.

Parental Satisfaction

Parental satisfaction was also assessed through video calls on the seventh day and three months after discharge. Satisfaction levels were evaluated using a 5-point Likert scale, commonly employed in clinical studies with ratings as follows: 1=very dissatisfied, 2=dissatisfied, 3=neutral, 4=satisfied, 5=very satisfied.

Parental Medication Awareness

Parental medication awareness was evaluated via telephone follow-up on the seventh day after discharge. The level of awareness was categorized into unawareness, basic awareness, and complete awareness. The formula for calculating the medication awareness rate was: (basic awareness + complete awareness) / Total number of cases × 100%. The awareness rates were compared between the two groups.

Incidence of Adverse Reactions

Over the three-month nursing care period, all adverse reactions identified by the medical and nursing team, as well as those reported by children and their parents, were recorded. These included skin blistering, crusting, scarring,

hyperpigmentation, hypopigmentation, itching, and systemic symptoms such as dizziness, nausea, and vomiting. The incidence rate of adverse reactions was calculated using the formula: (Number of adverse reaction cases / Total number of cases) × 100%. The incidence rates were compared between the two groups.

Ethical Approval

The ethical approval for the study was obtained from the Ethics Committee of the Special Medical Center of the Chinese People's Liberation Army Air Force, Beijing (Ethical approval # 2024–60-PJ01). Since the study was retrospective, therefore, the data were collected from the medical records without direct involvement of patients during data collection. Therefore, the need for human consent was waived by the ethics committee. The confidentiality of the participants' data was guaranteed through anonymization, and the study was conducted in accordance with the Declaration of Helsinki.

Statistical Analysis

Data analysis was performed using SPSS software version 27.0.1.0. Continuous variables were presented as mean ± standard deviation and compared between groups using the Mann–Whitney *U*-test/ANOVA test. Categorical variables were expressed as frequencies and percentages and compared between groups using the Chi-square test/Fisher's exact test.

Results

Based on the inclusion and exclusion criteria, a total of 153 children were enrolled in the study, with 76 in the study group and 77 in the control group. The clinical characteristics of the children in both groups were compared. There were no significant differences in gender, age, type of birthmark, or type of laser used for treatment between the two groups (P > 0.05). Refer to Table 1 for details.

Pain Assessment

The FPS-R on the seventh day after discharge indicated that children in the study group who received integrated care had significantly lower pain scores than those in the control group (P=0.012). Please refer to Table 2.

Table 1 Comparison of Clinical Characteristics Between Two Groups

	Study Group	**Control Group**	**P-value***
n	76	77	-
Age (mean ± SD)	7.20±2.97	8.42±2.82	0.498
Gender			0.404
Male	31	42	
Female	45	35	
Type of Birthmark			0.996
Pigmented	55	56	
Vascular	9	10	
Developmental	12	11	
Type of Laser Equipment			0.750
Q-switched	39	34	
Dye	9	8	
CO_2 laser	28	35	

Note: *p-value is calculated by the Chi-square test.

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Table 2 Comparison of FPS-R on the Seventh Day After Discharge Between Two Groups

	Study Group	Control Group	P-value*
N	76	77	-
FPS-R (mean ± SD)	1.5200±0.77	2.3846±1.47	<0.001
Median (IQR)	1.42 (0.93)	2.39 (1.53)	

Note: *p-value is calculated by the Mann–Whitney *U*-test.

Parental Satisfaction

Using repeated measures of ANOVA, the parental satisfaction levels at seven days and three months after discharge were significantly higher in the study group compared to the control group (P<0.001). However, the comparison of satisfaction levels within groups at the two time points, as well as the interaction effects between different groups and different time points, did not show statistical significance. This could be attributed to the limited number of assessment time points used. For detailed results, refer to Table 3.

Parental Medication Awareness

On the seventh day following discharge, despite the study group having a higher parental medication awareness rate compared to the control group, the difference between groups was not statistically significant. However, it is noteworthy that the parental medication awareness rate in the study group reached 100%. Please refer to Table 4.

Incidence of Adverse Reactions

Within the three months, the types of adverse reactions reported by the two groups were distinctly different. The control group reported severe local or systemic reactions such as scarring, hyperpigmentation, and vomiting, whereas the study group reported only transient reactions such as crusting and blistering, with no systemic reactions. This indicates that although the incidence rates were similar between the two groups, the children in the study group experienced milder and

Table 3 Comparison of Parental Satisfaction Levels Between Two Groups at Seven Days and Three Months After Discharge

	Study Group	Control Group	P-value*
N	76	77	-
Seven-Day (mean ± SD)	4.88±0.332	4.00±1.020	-
Three-Month (mean ± SD)	5.00±0.000	4.12±0.952	-
Groups	-	-	<0.001
Satisfaction Levels	-	-	0.059
Satisfaction Levels * Groups	-	-	0.970

Note: *p-value is calculated by ANOVA.

Table 4 Comparison of Medication Awareness on the Seventh Day After Discharge Between Two Groups

	Study Group	Control Group	P-value*
N	76	77	-
Unawareness	0	9	-
Basic Awareness	4	3	-
Complete Awareness	72	65	-
Awareness Rate	100%	88.3%	0.235

Note: *p-value is calculated by chi-square/fisher's exact test.

Table 5 Comparison of Adverse Effects Between Study and Control Groups

Adverse Effect	Study Group (n=77)	95% CI (Study)	Control Group (n=76)	Confidence Interval 95% (CI) (Control Group)	p-value*
Blistering	9/77 (11.7%)	6.3–20.7%	0/76 (0.0%)	0.0–4.8%	0.003
Crusting	3/77 (3.9%)	1.3–10.8%	0/76 (0.0%)	0.0–4.8%	0.245
Hyperpigmentation	0/77 (0.0%)	0.0–4.8%	4/76 (5.3%)	2.1–12.8%	0.058
Scarring	0/77 (0.0%)	0.0–4.8%	3/76 (3.9%)	1.4–11.0%	0.120
Vomiting	0/77 (0.0%)	0.0–4.8%	8/76 (10.5%)	5.4–19.4%	0.003

Note: *p-value is calculated by Fisher's Exact Test.

Table 6 Adverse Event Definitions and Severity Grading (Adapted from CTCAE v5.0

Adverse Event	Grade 1 (Mild)	Grade 2 (Moderate)	Grade 3 (Severe)	Grade 4 (Life-Threatening)
Blistering (Study group)	Localized, small, painless, and resolves spontaneously	Multiple or painful, requiring a simple dressing		
Crusting (Study group)	Localized, dry, resolves without treatment	Moderate, symptomatic, requiring topical care		
Hyperpigmentation (Control group)		Moderate, cosmetically noticeable, topical treatment needed		
Scarring (Control group)		Visible, requiring cosmetic intervention		
Vomiting (Control group)		3–5 episodes in 24 h, requiring antiemetics		

more transient reactions due to the integrated care approach. Blistering was observed exclusively in the study group (11.7%, 95% CI: 6.3–20.7%), with a statistically significant difference compared to the control group (0%; p = 0.003). Crusting was also reported in the study group (3.9%, 95% CI: 1.3–10.8%), however, this difference was not statistically significant (p = 0.245). Conversely, hyperpigmentation (5.3%, 95% CI: 2.1–12.8%), scarring (3.9%, 95% CI: 1.4–11.0%), and vomiting (10.5%, 95% CI: 5.4–19.4%) were noted only in the control group. Among these, vomiting occurred significantly more often in the control group (p = 0.003), while differences in hyperpigmentation (p = 0.058) and scarring (p = 0.120) did not reach statistical significance. Please refer to Tables 5 and 6.

Discussion

Integrated care represents a modern trend in worldwide healthcare services. In 2016, the WHO published a vision for integrated care, defining it as 'health services that are managed and delivered so that people receive a continuum of health promotion, disease prevention, diagnosis, treatment, disease-management, rehabilitation and palliative care services, coordinated across the different levels and sites of care within and beyond the health sector, and according to their needs throughout the life course.[19] Currently, most research and practice in integrated care focus on chronic diseases, geriatric ailments, and physical disabilities, such as hypertension, diabetes, cancer, and complex fractures.[22] However, there is insufficient attention to pediatric health and dermatological care. Similar to disabilities from burns,[23] facial and cervical birthmarks can have a long-term and severe impact on children's appearance, significantly affecting the quality of life and psychological well-being of children and their families. These children, too, require special attention and integrated care.

In this study, for the first time, we have demonstrated the efficacy of integrated care in managing large facial and cervical birthmarks in children undergoing laser treatment. For the study group, the integrated care based on the integrated care models significantly alleviated children's pain and increased parental satisfaction. These findings are consistent with those of Li et al,[24] and align with Christakis's research, which also highlighted the correlation between continuity of care and high-quality care reported by parents.[25] It is particularly noteworthy that parental presence and involvement play a crucial role in the treatment process for children's birthmarks.[26] Given the necessity for multiple laser

treatments for pediatric birthmarks, high parental satisfaction boosts their confidence and willingness to adhere to medical advice and persist through the treatment cycle, thereby enhancing the child's chances of recovery and improving the future quality.

Following laser treatment, topical medications are critical for wound care. Since the children are at a young age, parental awareness of medication usage is vital for the recovery of wounds. Selzer's study indicates a strong correlation between parental medication misunderstanding and potential harm at discharge for children with complex conditions.[27] However, our study did not observe a statistically significant difference between conventional nursing care and integrated care regarding parental medication awareness, as even the control group reported a high awareness rate of 88.5%. This high awareness could be attributed to the high attention that parents typically pay to their children's birthmarks and the high concern they have for their child's health, which naturally leads to high medication awareness. On the other hand, the study group reported a medication awareness rate of 100%, which still partially demonstrates the efficacy of integrated care in enhancing parental awareness of the importance of medication in wound care.

Similar to the medication awareness rates, both the study and control groups reported low incidence rates of adverse reactions, with no statistically significant difference. Nevertheless, the types of adverse reactions reported differed substantially between groups. The study group reported only minor and transient local skin reactions, while the control group had severe and long-term local skin reactions, such as scarring and hyperpigmentation, as well as systemic reactions, like vomiting. This difference in the severity and type of adverse reactions shows the advantage of integrated care in the treatment of pediatric birthmarks. The combination of the medical and nursing team and the use of shared electronic medical records facilitated a deeper understanding of patient conditions, allowing for more personalized medication treatments and care recommendations, and a more accurate detection of potential adverse reactions. Furthermore, the professionalism of the medical and nursing team, coupled with their approachable and patient manner, fostered better trust among parents and encouraged them to report adverse reactions promptly. Through ongoing remote coordination and care, once an adverse reaction was identified, the child's care coordinator could immediately communicate with the medical team, ensuring fast intervention and necessary adjustments to the care plan. For this reason, the adverse reactions reported in the study group were minor and transient. On the other hand, the control group experienced more severe and prolonged adverse reactions due to less attention from doctors and nurses, lower parental trust in the health care providers, and a more passive attitude toward reporting adverse reactions, which leads to delays in addressing these issues. Similar to our findings, Wang's study highlights the role of integrated care in reducing the incidence and severity of adverse reactions post-treatment in children.[28] Similarly, a few studies also highlight the importance of integrated care in seeking healthcare for burn patients. Combining care pathways and integrating disciplines can improve service delivery, reduce delays, and improve diagnosis/treatment decisions.[23,29] The care approach followed in our study is in line with the recommended structured follow-up approach for the provision of care to neonatal and pediatric patients.[30]

Undeniably, our study has several limitations. First, due to the limited number of pediatric cases of large birthmarks under general anesthesia, a retrospective study design was utilized, which may affect the generalizability of the findings. Second, given the prolonged time of birthmark treatment, which often requires multiple sessions, this study's follow-up period of only three months may not be sufficient to fully assess the effects of integrated care on treatment outcomes, such as long-term quality of life for children and their families or adherence to subsequent treatments. Third, the limited cognitive abilities of the young children involved have led us to rely on subjective and simple assessments for our observational parameters, which may not be a comprehensive evaluation. Fourthly, we also acknowledge potential observer and reporting bias, the possibility of ceiling effects influencing satisfaction scores, and the likelihood that parental perceptions may have shaped reported improvements in pain and satisfaction, independent of objective clinical outcomes. Fifth, our findings suggest that integrated care may improve outcomes in children undergoing laser treatment; however, generalizability may vary across healthcare systems with different resource availability, staffing models, and follow-up structures. Additionally, outcomes may differ with other types of laser devices, treatment protocols, or clinical settings. Also, we did not stratify patients by lesion type, location, or size, which limits our ability to determine whether specific subgroups derived greater benefit from the integrated care approach. Future studies should incorporate stratification to identify which patient subgroups derive the greatest benefit. Finally, the effectiveness of integrated care, along

with various parameters such as pain assessment, parental satisfaction, and the incidence of adverse effects, could only be evaluated after the laser treatment. As a result, collecting baseline data was not feasible.

Conclusion

This study confirms that the integrated care provision was associated with improved outcomes in the treatment of large facial and cervical birthmarks in children undergoing laser therapy. The integrated care approach provided the first evidence of the efficacy of integrated care in laser treatment, particularly in alleviating pain levels and enhancing parental satisfaction. It also mitigated the severity of post-discharge adverse reactions. Integrated care improves treatment outcomes and the care experience for families of these special children, warranting further investigation. The durability of benefits, particularly in terms of scar quality and recurrence, remains uncertain and requires longer-term evaluation in future studies. There is a need for future multicenter, randomized controlled trials with extended follow-up periods to validate our findings and evaluate long-term outcomes.

Disclosure

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