

Review Article:

Laser treatments for paediatric skin conditions: A review.

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Abstract

Lasers can treat a wide variety of conditions in paediatric dermatology with significant benefits and limited morbidity. Vascular lesions such as IH and PWS are the most frequently treated in an outpatient setting. Bodily appearance plays a vital role in an individual's intelligence, occupational and social success, and social status. The paediatric population comes with an indication for lasers have had their conditions since birth, such as birthmarks. In school-aged children, visible disfiguring skin lesions can lead to aversive behaviour, feelings of shame, and depression in the child, which can affect their psychological health and their ability to contribute to society as an adult. As children are needle-phobic, procedure-phobic, or pain-phobic, a physician may need to take steps to ensure a successful experience. Physicians' experience in treating with laser is important in the outcome of laser therapy intervention.

Key words: Laser, Children, Paediatric dermatology, Infantile haemangioma

Introduction:

Applying lasers on infants, children and adolescents comes with a very special set of considerations regarding whether physicians may not associate with adult patients. Lasers have revolutionized how we treat various skin conditions, including vascular malformations, vascular tumours, pigmented lesions, acne, psoriasis, hypertrichosis, scars, and many others; moreover, lasers have introduced novel management options for dermatologic conditions unique to infants, children, and adolescents. Most children who come with lasers have had their conditions since birth, such as birthmarks, whereas adults have conditions brought on by the sun. If a child is scared about having a laser procedure as they are needle phobic, or procedure phobic, the physician may take essential steps to ensure a successful experience.

Up to the present time, there are no well-established guidelines regarding laser therapy for the treatment of cutaneous lesions in paediatric patients. Here we find out the types of lasers commonly used, the types of lesions treated, and factors that affect the selection of specific laser modalities in paediatric patients. Physical appearance plays a role in how

others judge an individual's intelligence, occupational and social success, and social status.¹ Adults with disfiguring cutaneous lesions may use the deformity to define their identity in social interactions.² This deformity is often used to explain failures and difficulties, and after correction, disillusionment can ensue when these individuals realize that even "normal" people encounter life stressors.³ Cutaneous deformities in children can negatively impact school performance, teacher expectations, parent-child interactions, social development, and self-esteem.⁴ children can become socially handicapped and develop both behavioural and emotional problems secondary to their physical appearance.⁵ In school-aged children, visible disfiguring skin lesions can lead to aversive behaviour, feelings of shame, and depression in the child, which can affect their psychological health and their ability to contribute to society as an adult.⁶ Not surprisingly, treating disfiguring cutaneous lesions at a younger age decreases the psychosocial sequelae of the deformity.² Treated adults were less worried about their appearance after therapy; however, their perception of how others view them and their social interaction

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with others is not affected.² This point is important to consider when deciding the appropriate age for cutaneous lesion treatment. If treatment is pursued later in life, the psychosocial effects can persist into adulthood.² For these reasons, early treatment of potentially stigmatizing skin lesions is advisable.

Patient preparation, caution and setup for Laser procedure for children:

Analgesia and anaesthesia for laser procedure
In laser procedures for different cutaneous indications of children adequate, simple safe analgesia or anaesthesia is a vital concern. Topical anaesthetic agents and oral analgesics are sufficiently used in many cases. But in some situations, general anaesthesia is also needed for larger treatment areas or restless children. Caution should be taken to avoid applying too much when topical anaesthetics are used in children, as it can be toxic for children aged one to three.

EMLA cream is contraindicated in infants of less than 3 months of age as the use of large doses of prilocaine-containing formulations may cause an increase in the methaemoglobin (MetHb) concentration in infants and neonates.⁷ In infants aged 3–12 months, no clinically significant increase in MetHb was observed after a 2 g (lidocaine-prilocaine cream) (EMLATM) effectively EMLA dose was applied to the skin for 4 hours.⁷

Table I:

Age group	Maximum dose (g)	Maximum skin area (cm ²)
0-2 months	1	10
3-11 months	2	20
1-5 yr	10	100
6-11 yr	20	200

Eye protection:

Eye protection is an important issue for laser rooms during procedures and especially for children. Steel goggles or glasses that filter out the specific wavelength of laser light are routinely used for eye protection in adults. For periorbital laser treatments,

metal contact lenses can provide complete corneal protection for the patient. In the paediatric population, standard protective eye equipment may be too large or uncomfortable to provide adequate protection. One alternative form of opaque eyewear is to use overlapping patches of white gauze to fit the contour and size of the periorbital area and secure it with paper tape. PDL light is not transmitted through the patches, as tested by laser meter photometry. For periorbital laser treatments, standard corneal shields that have handles and come in both adult and child sizes can be used. These shields are easy to place and remove and are tolerated by most children and adolescents.⁹

Special arrangement for children:

One effective option, especially for procedures below the head and neck, is to form a parent-child tent.¹¹ In this model, one clamps a cotton or polyester sheet to the top of the treatment table such that the parent and patient remain in a protected tent.¹⁰ The sheet is doubled to prevent any possibility of penetration from the laser. Testing of PDL light did not show detectable evidence of penetration.¹⁰ One of the major benefits of this technique is that it allows the parent and the child to interact during the procedure, which can decrease anxiety related to the therapy.

An international survey recommended starting the procedure within 30 seconds after entering the procedure room with reassurance and possibly holding or holding down. The key is to begin the procedure as soon as possible after entering the room with reassurance so that they got less time to think about backing out of it. Hence, staff should complete preparations before a physician's entrance. If the treatment area is the child's face, the child has been equipped with goggles, and a staff person watches the child so that he doesn't remove them. Parents may hold a child's hand or even a smaller child.¹¹

In the case of using generally in case of larger lesions or lengthier procedures, the family members are aware of known and not known the probable risk of using it. Usually, the physician will apply the laser in the same way for children as for adults, but they may administer treatment more slowly.

Clinical settings of Laser procedures for children:

For childhood skin conditions laser procedures are conducted mostly in an office-based setups. In many cases, Laser surgeries need to be done in the hospital surgery centre. Sometimes Laser procedures can be conducted in an ambulatory surgery centre. The use of different setups has been presented in the table II.¹²

	Outpatient ambulatory surgery centre (%)	Office-based procedure room (%)	Academic/hospital surgery centre (%)
Lasers in general	19.2	76.2	52.3
Vascular lasers	7.0	64.3	28.7
Pigment lasers	4.6	79.3	16.1
Resurfacing lasers	9.4	64.7	25.9
Laser hair removal	2.4	84.3	13.3

Two respondents indicated “other” clinical settings, which were (i) an outpatient dermatology clinic hospital and sedation unit hospital and (ii) a laser centre.

Skin conditions suitable for Laser therapy and appropriate Laser device:

Laser procedures have been tried in different paediatric skin conditions with variable outcomes. Infantile haemangioma (IH) on a different part of the face different ages of children, isolated facial angiofibroma, complex capillary-venous-lymphatic malformation, hypertrophic scar, traumatic tattoo and hypertrophic scarring, refractory warts and excessive facial or body hair. Some isolated case reports on laser therapy in conditions like epidermal nevi, spider angiomas, pyogenic granuloma, molluscum contagiosum, inflammatory linear verrucous epidermal nevi, morphea, striae, lymphangioma circumscriptum, vitiligo, nevus spilus and Darier disease also have been found (Table III).¹³⁻¹⁴

Table III: Different dermatological conditions treated with different Laser13-16

1. Eyelid IH in 2-month-old	Topical Timolol, Oral Propranolol	Combine with PDL
2. Ulcerated Facial IH in a 4-month-old	Oral propranolol	PDL
3. Involved Facial IH in a 3-year-old	Propranolol	PDL & Fractional Ablative Laser followed by PDL or, PDL plus non ablative laser only PDL
4. Isolated Facial angiofibroma in a 12-year-old	Topical Sirolimus	Combination of the vascular and ablative device with Sirolimus
5. Complex capillary-venous-lymphatic malformation of the hip in a 12-year-old	-	PDL plus another vascular Laser PDL plus Fractional Laser
6. Hypertrophic scar on the forearm in a 16-year-old	-	PDL with Intralesional therapy PDL with fractional co2 laser with or without PDL
7. Traumatic tattoo and hypertrophic scarring on the face in a 15-year	-	Qs laser plus fractional laser Qs laser plus fractional Laser with Intralesional Steroid
8. Multiple refractory warts on the fingers of a 6-year-old	-	Vascular Laser
9. Laser hair removal		Long pulsed Nd:Yag laser DIODE Long-pulsed Alexandrite Laser
10. Psoriasis		Excimer Laser
11. Hidradenitis Suppuritiva		Laser hair removal by effective follicle destruction Recurrent nodule & abscess by Laser Debulking by ablation A variety of lasers have been described in the treatment of HS including LP Nd: Yag, IPL, Alexandrite, Diode, and CO2 ablative lasers. ⁴⁵
12. Lymphatic Malformation		P Nd:Yag and LP Alexandrite lasers especially if there is a haemorrhagic component present within the blebs. CO2 (10,600 nm, ablative fractionated laser, 25 MJ, 2 passes, 10% Ablative Laser when lacking haemorrhagic component
13. Keratosis Rubra Pilaris	Emollient	pulsed dye laser is the most effective with longer-lasting

14. Others (Epidermal Nevi, spider angiomas, pyogenic granuloma, molluscum contagiosum, inflammatory linear Verrucous epidermal nevi, morphea, striae, lymphangioma circumscriptum, vitiligo, nevus spilus, darier's disease)	Lesion location, size, severity, prior failed therapies, and potential for functional impairment all likely have an impact on these decisions. According to practitioners' choice.
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The laser procedure shows promising results where there were no other options. Counselling about the procedure and treatment outcome is the main challenge. Usually dermatologists are reluctant using general anaesthesia in paediatric patients; they prefer to use topical anaesthesia in patients. But in practically all cases cannot be done without general anaesthesia.

Pulsed Dye Laser (PDL):

A wide variety of lasers is used in children for different skin conditions, but PDL is by far the most popular choice. This may be in part because vascular lesions, such as Port wine stain (PWS) and IH are the commonest conditions to be treated in the paediatric population.¹⁵⁻¹⁸ Additionally, PDL is known to be a versatile laser that can be used to treat a variety of other cutaneous conditions, such as rosacea, scars, striae rubra, and verruca.¹⁹ PDL was the most popular laser among survey participants is consistent with the many potential applications of this laser modality.

Infantile Haemangioma

A variety of treatment options are available for IH, including oral and topical beta-blockers, systemic and Intralesional steroids, laser, and surgical resection. IH follows the classical course of rapid growth, plateau, and gradual involution, whereas considerable cases demand intervention due to the location of haemangioma, the probability of functional impairment, size, and chances of ulceration. In this survey, the most common treatment choices for ulcerated IH were PDL + oral propranolol and propranolol followed by PDL, if no improvement. Combination approaches such as these may be preferred by providers for treating complicated IH, and further studies are needed to explicate these findings.¹⁵⁻¹⁷

Portwine Stain (PWS)

Port-wine stain (PWS) is the most common congenital vascular malformation, with an incidence of 3 per 1000 live births. If left untreated, it can

significantly affect the psychosocial development of the inflicted individual.²⁰ The depth of a PWS can range from 1-5 mm with thinner lesions seen in infants and children and thicker lesions seen in adolescents and adults.²⁰ PWSs in children, in addition to being thinner, lack of large ectatic vessels or a nodular component, making them amenable to PDL therapy. Treatment should focus on targeting the small superficial capillaries seen in early PWSs, as these are easier to treat with PDL. The thinner skin of infants and their smaller, more superficial vessels makes treatment at an early age the most likely to be successful. PDL is the current standard of care for PWS, and it is believed that earlier treatment usually results in better clinical outcomes.²⁰ Several approaches are used for the treatment of recurrent or resistant PWS, including adding lasers of different wavelengths, changing the pulse duration, or multiple laser passes. In some situations adding topical sirolimus to PDL therapy may be a good option.²¹⁻²³ A review of 49 infants who started laser treatment before age 6 months found an average clearance of 89% after 1 year.²⁴ In addition to more effective treatment, evidence suggests that children ages 6 and younger have cleared of their PWS with fewer treatments than older individuals.²⁴ This is of particular interest because repeated laser treatments are associated with a very low chance of hypertrophic and atrophic scarring. Although approximately 80% of PWSs improve with treatment, only 20% clear completely. In general, patients with PWSs should be referred for treatment early in infancy with frequent treatments (every 2-4 weeks for 12 sessions). As PWSs mature, they hypertrophy, evolving from a vascular patch into a thick plaque with a variably nodular texture. The mean age of hypertrophy is around 37 years old, and by age 46, two-thirds of PWSs have become hypertrophied. Nodular vascularities may bleed easily and become an entry point for infection. Soft tissue overgrowth may ensue, resulting in dysmorphism, asymmetry, and functional impairment, particularly if involving the lip or eyelid. PDL is the current standard of care for PWS, and it is believed that earlier treatment usually results in better clinical outcomes. Several approaches have been tested for the treatment of recurrent or resistant PWS, including adding lasers of different wavelengths, changing the pulse duration, or multiple laser pass²⁰⁻²¹ In a survey, most respondents

favoured using other lasers of different wavelengths. In addition, several studies have shown that adding topical sirolimus to PDL therapy may also be a good option.²³ However, these survey results indicate that this is not yet a widely adopted practice. This could be due to a variety of factors, including unfamiliarity with this relatively new treatment option, cost or other difficulty obtaining the medication (which must be compounded), or inexperience applying the medication.

Other types of vascular lesions

For other types of vascular lesions, combination therapy is a popular option. Topical sirolimus plus laser therapy is effective for the treatment of angiofibroma, and PDL plus other lasers are effective for complex vascular malformations.²⁵⁻²⁶ Acceptance of these reported treatment modalities is reflected in the results of this survey. Remarkably, more respondents use topical sirolimus for angiofibroma than for PWS. This incongruity could be elucidated by the relatively poor response of angiofibroma to laser therapy alone. Patients would likely start treatment with topical sirolimus before considering laser therapy, as opposed to PWS, where laser alone is the treatment of choice with generally excellent results.

Q-switched Laser:

Nevus of Ota: Early in life, a nevus of Ota has a lighter, browner colour. Over time, under the influence of ultraviolet light and sex hormones, it can darken and become more blue-green. Evidence suggests that blue-green lesions are less amenable to Q-switched ruby laser therapy than brown lesions and require an increased number of treatments for clearance.²⁷ In addition, the histologic depth of the nevus of Ota can change over time. Recent evidence suggests that nevi with depths of 1 mm or less are associated with excellent clearance after treatment with a Q-switched alexandrite laser.²⁸ So, the introduction of an early childhood treatment can lead to better clearance.

Other conditions including hypertrophic scars, excessive hair, congenital melanocytic nevi, nevi of Ota, café au lait macules, psoriasis, and warts are treated with laser. Selecting Lasers is practitioner-dependent; the actual decision depends on the site of the lesion, size, severity, prior failed therapies, and potential for functional impairment. Among them, hypertrophic scars are commonly treated in the paediatric population, in the majority

of situations using combination therapy with lasers and intralesional agents.

Conclusion:

Laser therapy is used for a variety of cutaneous conditions in the pediatric population. Vascular lesions such as IH and PWS are the most frequently treated, and most providers are treating in an outpatient setting. Most practitioners avoid general anesthesia in children but may use it in certain cases. There is also a practice gap between evidence for the efficacy of topical sirolimus in refractory PWS and its clinical use. The number of years in practice may affect treatment choice depends on the clinical context.

Conflict of interest:

None.

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