Utilization of Laser Therapy During Pregnancy: A Systematic Review of the Maternal and Fetal Effects Reported From 1960 to 2017

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BACKGROUND Due to concerns regarding maternal and fetal safety and the absence of evidence to the contrary, laser treatment during pregnancy has traditionally been limited to situations of absolute necessity.

OBJECTIVE This review seeks to examine the available evidence to determine the safety of laser therapy during pregnancy.

METHODS Medical databases were searched for relevant reports from all specialties regarding the use of lasers during pregnancy from 1960 to 2017. A legal case review was also performed.

RESULTS Twenty-two publications in the literature reported the use of various laser wavelengths in 380 pregnant women during all trimesters. Other than 1 case of premature rupture of membranes questionably related to the laser treatment, there were no cases of maternal or fetal morbidity or mortality, premature labor, or identifiable fetal stress.

CONCLUSION The available evidence, limited to low evidence level case reports and series, indicates cutaneous laser treatment during pregnancy is safe for both mother and fetus. Furthermore, laser physics and optics dictate there should theoretically be no risk of fetal laser exposure from commonly used cutaneous lasers.

The authors have indicated no significant interest with commercial supporters.

Elective laser therapy during pregnancy is not generally advised by health care professionals and is, therefore, encouraged to be performed postpartum.[1–3] Manufacturers commonly list pregnancy as a contraindication to patient selection for laser treatment; however, there is no evidence to support this guideline.

Many skin changes of potential concern to the patient, or even with some degree of morbidity, may occur during pregnancy. Conditions such as acne, granuloma gravidarum, other vascular lesions, verrucae, condyloma, keloids, hypertrichosis, hyperpigmentation, or even other cosmetic concerns could benefit from laser therapy during pregnancy.[4,5] With neither standardized guidelines nor a clear understanding of fetal risk due to limited available data, health care professionals have traditionally cautiously practiced by the principle of nonmaleficence when treating the pregnant patient. Laser use in pregnancy has been limited mainly to situations of necessity after exhausting other options and deferring most treatments until after parturition.

As with other dermatologic surgery procedures undertaken during pregnancy, experts recommend performing necessary laser treatments during the second or early third trimester of pregnancy to avoid

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ISSN: 1076-0512 • Dermatol Surg 2019;45:818–828 • DOI: 10.1097/DSS.0000000000001912

spontaneous abortion or preterm labor.[2,6] These recommendations are based on the physiologic stages of fetal development pivotal for practitioners to understand when counseling and treating the gravid patient. Importantly, the first trimester of fetal growth is crucial for organogenesis, during which time there is a 12% risk for spontaneous abortion, whereas this number decreases to 5% during the second and third trimesters.[2,7] Beyond Week 20, the fetus is resistant to developmental defects, although the third trimester presents an increased risk of premature birth.[2]

Concern for unnecessary physiological stress to the fetus has supported the argument against elective laser therapy during pregnancy. Physiologic changes in maternal heart rate, temperature, and blood pressure serve as adequate markers of fetal stress affecting uterine perfusion and oxygenation.[2,8,9] Increases in maternal cortisol, which can be detected as early as 17 weeks in amniotic fluid, may also serve as a marker of fetal stress. Multiple studies have shown identifiable postnatal deficits, including delays in infantile mental and motor development, that manifest due to prenatal stressors and elevated maternal cortisol during pregnancy.[10–12] To date, however, there has been no report of maternal laser therapy inducing fetal stress. In the few cases when fetal stress was specifically monitored, none was detected.[13–15]

The authors reviewed the available literature to evaluate fetal risk during maternal laser treatment to establish appropriate guidelines for laser therapy during pregnancy.

Methods

A literature search was conducted using the following electronic databases: the Cochrane Library, PubMed, Google Scholar, and EBSCO CINAHL Plus Database. The searches were limited to the years 1960 through September 2017. MESH headings included "exp Laser therapy [MESH]" and "exp pregnancy OR pregnancy complications [MESH]," and keywords used included "pregnancy," "fetal risk," "abortion," "physiological fetal stress," "pregnancy trimester risk," "laser safety," "laser therapy," "patient safety," "Nd:YAG laser," "ablation CO2," "preterm labor," "KTP," "PDL," "diode," "erbium:YAG," and "excimer." Results were restricted to the English language and humans only. Bibliographies of articles were examined for additional relevant studies. The literature contained publications regarding the use of lasers during pregnancy from 1978 to 2015. Various case reports, clinical trials, cohort studies, and retrospective literature reviews from all specialties and their indications for laser usage regardless of their level of evidence were reviewed, and all related to cutaneous laser applications in pregnant women were included.

A legal research review was conducted using the academic database LexisNexis. The aim of this review was to identify legal cases, federal and state, citing laser therapy performed during pregnancy as a suspected contributing factor towards fetal harm or fetal termination during pregnancy. The LexisNexis review was performed December 3, 2017, with the following search: ((laser) AND (therapy OR treatment)) AND (pregnant OR pregnancy) AND (fetus OR Fetal) AND (risk) AND (death) OR pregnancy (complication* OR reaction OR "adverse effect*" OR "adverse event*" OR "side effect*"). The report generated 76 legal cases. Among these cases, there were no cited litigations, which identified or proved laser therapy as a cause of fetal harm or termination during pregnancy.

Results

In sum, 380 women treated with lasers during pregnancy were evaluated from 22 studies. Reported ages ranged from 14 to 41, and data originated from various parts of the world. Indications for laser treatment included cervical adenocarcinoma, urolithiasis, condyloma acuminata, cervical carcinoma in situ, cutaneous scarring, Buschke–Löwenstein tumor, verrucous carcinoma, and acne vulgaris. Laser wavelengths reported include the 504-nm pulsed-dye laser (PDL), which is a PDL wavelength used in lithotripsy, 532-nm potassium titanyl phosphate (KTP), 1,064-nm neodynium:yitrium aluminum garnet (Nd:YAG), 2,100-nm holmium:YAG, and 10,600-nm carbon dioxide (CO_2). Among all studies, there was no definitive evidence for spontaneous abortion, fetal malformations, or preterm labor occurring secondary to laser therapy during pregnancy. Schwartz

and colleagues[16] reported a case of 1 patient with premature rupture of the membranes (PROM) 4 days after CO_2 laser therapy for condyloma acuminata was performed at 35 1/7 weeks. The cause of the rupture was unclear, and it was uncertain whether this was related to the laser procedure. The infant delivered at 36 4/7 weeks with no further complications. Two other patients of the 32 women in the study also experienced PROM 7 weeks and 10 weeks after the procedure, respectively. These cases were believed not to be related to the procedure. The overall PROM rate in the patients in the study did not differ statistically significantly from the rate in the matched control group. In addition, 2 patients received tocolytics prophylactically to suppress mild contractions after laser treatment. These were counted as premature onset of labor, but they technically did not reach true labor. Furthermore, this premature labor rate did not differ statistically significantly from the premature labor rate in the control group.[16]

A summary of all the reviewed cases is in Tables 1–4, and several representative cases are discussed herein.

Although treatment of verruca vulgaris could likely be delayed until after pregnancy or treated with nonlaser methods, other verrucous lesions such as condyloma acuminata or verrucous carcinoma, including the Buschke–Löwenstein tumor, may warrant treatment during pregnancy. CO_2 laser is a treatment option that has been used safely for these lesions. Seven case reports and series have cumulatively reported the treatment of 248 patients with condyloma during pregnancy. Patients of varying ages and in all trimesters were treated without any identifiable adverse events except for the previously discussed single case of PROM. In another study of 16 women receiving CO_2 laser treatment for condyloma, several had premature contractions requiring tocolytics without true premature labor.[15] It is unlikely the laser treatment caused these events. CO_2 laser has ultimately been determined safe in pregnancy for the treatment of condyloma[3,9] (Table 1).

One 16-year-old gravid patient at 29 weeks presented with a 15-cm verrucous plaque on the labia leading to pain, disfigurement, and obstruction of the vulva. This Buschke–Löwenstein tumor was treated with 2 sessions of CO_2 laser treatment. The baby was born by cesarean section without complication at 36 weeks.[17] An oral-type verrucous carcinoma of the lip in a 34-year-old pregnant woman at 16 weeks' gestation was treated in 1 session with a CO_2 laser without known recurrence after 21 months and with good cosmesis. There were no reported pregnancy-related or delivery complications[18] (Table 1).

CO_2 laser treatment can be used for the treatment of various verrucous lesions due to both its safety and efficacy.[17,18] An Nd:YAG laser has also been used to treat condyloma in 19 pregnant women in all 3 trimesters of pregnancy without complications[19] (Table 2).

Seventy-five patients in another study were treated with a CO_2 laser for cervical carcinoma in situ, invasive cervical carcinoma, or various degrees of dysplasia. No control group was identified; however, the authors note that the use of CO_2 laser to perform the conization resulted in none of the adverse events reported with cold knife conization such as "bleeding, infection, cervical incompetence, cervical rigidity, premature delivery, fetal or maternal death, or other complications during delivery."[20] There were 2 spontaneous abortions temporally unrelated to the laser treatment. Also, there were 2 patients who experienced premature contractions at 20 and 24 weeks without premature labor and ultimately delivered without complications at term. Again, there were no adverse events attributable to the laser treatment[20] (Table 1).

Pyogenic granulomas, or lobular capillary hemangiomas (LCHs), sometimes appear during pregnancy and have been called "granuloma gravidarum". The Nd:YAG 1,064-nm laser treatment is a safe modality to treat ulcerated or painful lesions that do not regress postpartum to achieve hemostasis.[13] In one case, a 19-year-old patient presented at 33 weeks' gestation with a large $3.5 \times 2.5 \times 2.0$-cm painful LCH causing a negative effect on eating and oral hygiene. At 36 weeks' gestation, she underwent Nd:YAG laser treatment and subsequently delivered a healthy 3,884-g infant at almost 41 weeks. The only delivery complication was breech presentation requiring cesarean section.[13] It is difficult to attribute a breech pregnancy to a laser treatment (Table 2). In addition to the Nd:YAG laser, the PDL has also been reported to be safely used during pregnancy for verrucae

TABLE 1. Literature Summary—10,600-nm CO_2 Laser

Primary Author	*Year Published*	*Study Setting*	*No. of Pregnant Patients*	*Pregnancy Trimester**	*Treatment Indication*	*Additional Interventions*	*Complications From Laser Therapy*	*Other Complications Unrelated to Laser*
Malfetano and colleagues[40]	1981	United States	1	3	Condylomata acuminata		NR	NR
Ferenczy[41]	1984	Canada	43	1, 2, and 3	Condylomata acuminata	General or local anesthesia; follow-up excisional biopsy for residual disease if needed in some	NR	NR
Schwartz[16]	1988	United States	32	1, 2, and 3	Condylomata acuminata	85% trichloroacetic acid; suprapubic catheters in some	Possibly related premature rupture of membranes (PROM) in 1 patient 4 d after treatment; 2 patients with postop uterine contractions without onset of labor after prophylactic medical tocolysis; and no statistical difference in complication rate between cases and matched controls	Acute pyelonephritis in 1 patient with multiple previous urinary tract infections; 2 other PROM at 7 and 10 wk after treatment; and no statistical difference in complications between cases and matched controls
Adelson and colleagues[15]	1990	United States	16	2 and 3	Condylomata acuminata	General anesthesia or spinal block, indwelling urethral catheter in some due to postop vulvar edema	NR	6 patients had premature contractions; 2 within a week of laser therapy. Both delivered after 40 wk. Other 4 occurred 4–13 wk later. Three received tocolytics. Delivered at 34–39 wk. Causality cannot be certainly linked to or declared unrelated to the laser treatment. One patient with preeclampsia 13 wk after laser induced at 35 wk.
Woźniak and colleagues[42]	1995	Poland	11	2 and 3	Condylomata acuminata		NR	NR

TABLE 1. (Continued)

Primary Author	*Year Published*	*Study Setting*	*No. of Pregnant Patients*	*Pregnancy Trimester**	*Treatment Indication*	*Additional Interventions*	*Complications From Laser Therapy*	*Other Complications Unrelated to Laser*
Békássy and colleagues[20]	1995	Sweden	75	1, 2, and 3	Cervical carcinoma in situ	Local or general anesthesia; synthetic vasopressin and tranexamic acid IV	NR	2 spontaneous abortions unrelated to laser treatment; 2 premature contractions without premature labor and finally term deliveries; 2 preterm deliveries due to abruptio placentae and placenta previa unrelated to laser treatment; and 9-term c-sections due to various unrelated causes.
Chaisilwattana and Bhiraleus[43]	1996	Thailand	13	NR	Condylomata acuminata		NR	Mild to moderate vulvar pain
Arena and colleagues[44]	2001	Italy	115	1, 2, and 3	Condylomata acuminata		NR	NR
Gay and colleagues[45]	2003	France	18	2 and 3	Condylomata acuminata		NR	NR
Garozzo and colleagues[17]	2003	Italy	1	3	Buschke–Löwenstein tumor		NR	NR
Hsu and colleagues[18]	2007	Taiwan	1	2	Verrucous carcinoma		NR	NR
Cox and colleagues[22]	2015	United States	1	3	Scarring of the abdomen		NR	C-section for nonprogressive labor at 40 4/7 wk.

*Trimester 1 (1–12 weeks), Trimester 2 (13–28 weeks), and Trimester 3 (29–40 weeks).

NR, none reported.

TABLE 2. Literature Summary—1,064-nm Nd:YAG Laser

Primary Author	*Year Published*	*Study Setting*	*No. of Pregnant Patients*	*Pregnancy Trimester**	*Treatment Indication*	*Additional Interventions*	*Complications from Laser Therapy*	*Other Complications Unrelated to Laser*
Powell and colleagues[13]	1994	United States	1	3	Large granuloma gravidarum		NR	Breech presentation requiring c-section at 40 6/7 wk (laser at 36 3/7 wk)
Buzalov and Khristakieva[19]	1995		19	1, 2, and 3	Condylomata acuminata		NR	NR
Ballin and Uebelhoer[21]	2009	United States	1	1 and 2	Acne vulgaris	Underwent total of 10 weekly treatments	NR	NR

*Trimester 1 (1–12 weeks), Trimester 2 (13–28 weeks), and Trimester 3 (29–40 weeks).
NR, none reported.

and LCH due to its precise targeting of hemoglobin limited to the treated lesion.[9]

Acne and rosacea have both been successfully treated with various devices including the pulsed-dye and KTP lasers, intense-pulsed light, photodynamic therapy, and other laser wavelengths. Acne can be difficult to treat in pregnancy, since most systemic therapies and some topical treatments are contraindicated while even more are of potential or unknown risk. Furthermore, already in a setting of limited treatment options, acne can commonly worsen during pregnancy. In at least one case, severe, progressively worsening acne in a 38-year-old Asian woman at 6 weeks' gestation was treated with 10 weekly sessions of low-fluence 1,064-nm Nd:YAG laser using 400 to 800 pulses per session and standardized settings. This resulted in nearly 100% clearance of active inflammatory lesions and no reported pregnancy-related complications[21] (Table 2).

In another example, a 31-year-old woman with burn scars on the abdomen presented at 30 weeks' gestation with pain and restriction of her expanding abdomen. She received 2 treatments to the area with a fractionated CO_2 laser at 30 and 38 weeks' gestation with improved comfort and functionality during, as well as after, the pregnancy. She underwent cesarean section at 40 weeks for failure to progress and delivered a healthy baby without complication[22] (Table 1).

There are at least 7 manuscripts documenting the laser treatment of urolithiasis in 28 pregnant women with all 3 trimesters of pregnancy represented. Urolithiasis and the potential for subsequent renal colic, infection, or obstruction can lead to maternal or fetal morbidity and mortality.[23] In fact, preterm labor, preterm delivery, and PROM are all risks of urolithiasis necessitating treatment of this condition in pregnant patients when warranted.[23] Pulsed-dye, typically of 504 nm, and holmium:YAG 2,100-nm lasers were used without any negative fetal effects[14,24–27] (Tables 3 and 4).

All case reports and research studies consistently demonstrated laser therapy during pregnancy caused no identifiable adverse effects to the fetus including malformations, spontaneous abortion, or complicated or premature labor or delivery.

TABLE 3. Literature Summary—2,100-nm Holmium:YAG Laser

Primary Author	Year Published	Study Setting	No. of Pregnant Patients	Pregnancy Trimester*	Treatment Indication	Additional Interventions	Complications from Laser Therapy	Other Complications Unrelated to Laser
Scarpa and colleagues[14]	1996	Italy	3	2 and 3	Urolithiasis	Ureteroscopy; IV antibiotics; variable general or oral anesthesia/neuroleptics; and some with catheter placement	NR	NR
Watterson and colleagues[25]	2002	Canada	8	1, 2, and 3	Urolithiasis	Some with ureteral stents; ureteroscopy; IV antibiotics in all; and fluoroscopy in some	NR	NR
Akpinar and colleagues[46]	2006	Turkey	7	1 and 3	Urolithiasis	Fluoroscopy and ureteral stents in some; ureteroscopy; general anesthesia; and postoperative analgesia	NR	NR
Cocuzza and colleagues[26]	2010	Brazil	2	2 and 3	Urolithiasis	Fluoroscopy; ureteroscopy with basket removal of stones; and stents in some	NR	NR

*Trimester 1 (1–12 weeks), Trimester 2 (13–28 weeks), and Trimester 3 (29–40 weeks).

IV, intravenous; NR, none reported.

Discussion

This review provides a complete critical analysis of the limited available literature of fetal risk during maternal treatment with laser therapy. It includes all reports to date covering various laser wavelengths used in all trimesters. As laser therapy becomes more commonplace and more routinely performed for both cosmetic and medical indications, it is increasingly important to develop up-to-date evidence-based guidelines for the use of these treatments in the gravid patient. Beyond necessary treatments, the current review, for the first time, lends support for the safe use of lasers during pregnancy, in general, even potentially for elective indications. Unfortunately, the available literature is sparse. Randomized-controlled trials are lacking, and although 1 report did examine a matched control group, the available literature consists only of the case reports and series summarized herein.[16] Furthermore, recommended guidelines for laser therapy during pregnancy have not been established in the United States. In 2007, however, the European Society for Laser Dermatology reported vascular laser or intense-pulsed light sources to have no direct impact on pregnancy; yet, their guidelines restricted laser treatment to the third trimester once the fetus is fully developed.[28]

Basic science research has investigated the effect of visible light on gametes and embryos of various species. Pomeroy and Reed[29] concluded from their investigation into the effect of light on embryos that there are no conclusive data indicating that light is harmful to human embryos or gametes, although it can be harmful to nonprimate mammalian gametes and embryos. Jacques and colleagues showed in an experiment that shining light into the abdomen of certain pregnant small mammals resulted in small but significant amounts of light reaching the uterus. This may result in changes in fetal circadian rhythm and potentially affect the physiologic development of the visual system, itself, although it is unknown whether the affect would be positive, negative, or inconsequential.[30] Based on a nonliving experimental model, even late gestation human fetuses can potentially see low light in utero depending on abdominal thickness and various other environmental conditions. Whether this affects development is unclear.[31]

TABLE 4. Literature Summary—504–532-nm Lasers

Laser	*Wavelength (nm)*	*Primary Author*	*Year Published*	*Study Setting*	*No. of Pregnant Patients*	*Pregnancy Trimester**	*Treatment Indication*	*Additional Interventions*	*Complications from Laser Therapy*	*Other Complications Unrelated to Laser*
PDL	504	Carlan and colleagues[27]	1995	United States	1	2	Urolithiasis		NR	NR
PDL	NR	Scarpa and colleagues[14]	1996	Italy	3	2 and 3	Urolithiasis	Ureteroscopy; IV antibiotics; variable general or oral anesthesia/ neuroleptics; and some with catheter placement	NR	NR
PDL	504	Carringer and colleagues[24]	1996	Sweden	4	2 and 3	Urolithiasis	Nephrostomy tube, local anesthesia, and general anesthesia in some. Fluoroscopy, ureteroscopy, and mini-basket stone removal in all.	NR	Trisomy 18 in 1 child (laser performed 29 weeks); in another, delivery induced at 37 weeks due to "psychological reasons" without any issue with the child (laser at 30 wk)
KTP	532	Yahata and colleagues[47]	2008	Italy	4	2	Cervical adenocarcinoma	Local anesthesia, cold knife margin resection, cervical cerclage, and prophylactic tocolytic therapy	NR	Term delivery by C-section due to labor arrest in 1 patient

*Trimester 1 (1–12 weeks), Trimester 2 (13–28 weeks), and Trimester 3 (29–40 weeks).

IV, intravenous; NR, none reported; PDL, pulsed-dye laser.

Although the effects of visible light penetrating the uterus on a developing fetus are unknown, laser physics suggest a human fetus should not be adversely affected by visible, near-infrared, or infrared laser energy. Lasers used in medicine function using the principle of selective photothermolysis. The laser energy is intended to be absorbed by a chromophore such as oxyhemoglobin, deoxyhemoglobin, melanin, water, and so forth to cause a tissue effect through heat. Laser energy is either reflected, scattered, transmitted, or absorbed when administered to the skin. The depth of penetration of clinically meaningful laser energy would be unlikely to exceed 10 mm; in fact, 1,064-nm Nd:YAG lasers, which would be among the deepest penetrating lasers, are reported to penetrate up to only 4 to 7 mm.[32–34] Given this wavelength is used for heating some deeper tissues such as the deep subcutaneous tissue, this estimate may be inaccurate. Furthermore, some infrared lasers are believed to reach depths of up to 1 to 2 cm.[35] Given the thickness of the pregnant abdomen (30 mm on average[31]), the uterus, and amniotic fluid, clinically meaningful laser energy is very unlikely to penetrate to reach the fetus. KTP (532 nm), pulsed-dye (595 nm), alexandrite (755 nm), ruby (694 nm), diode (~810–820 nm), and ablative wavelengths such as 2,940 and 10,600 nm commonly used in dermatology all have even lower penetration depths compared with that of 1,064-nm lasers. Theoretically, then, these should impart even less potential for clinically significant penetration to a fetus.

To date, maternal pain has not been reported to have any effect on a fetus. Regardless, anesthetics, particularly topical formulations, are commonly used before laser procedures. The safety of various anesthetics in pregnancy has been reported in multiple studies. Lidocaine is considered safe to use in pregnancy, but mepivacaine and bupivacaine carry a potential risk of fetal bradycardia.[9,36] Accidental intra-arterial injection of lidocaine could pose cardiac risks.[3] Although caution is advised in its use in pregnancy, epinephrine has not proven teratogenic; in fact, in small amounts for dermatologic procedures, the benefits may outweigh the risk given the ability of epinephrine to reduce systemic levels and placental transfer of lidocaine.[9,36] Topical benzocaine is not recommended because of the potential for methemoglobinemia in infants.[3] Topical anesthetics containing lidocaine and prilocaine are widely considered safe.[3,9] With a topical eutectic mixture of 2.5% lidocaine + 2.5% prilocaine, analgesia reaches 3 and 5 mm in depth after 60 and 120 minutes of application time, respectively.[37]

As with electrosurgery, another important consideration in laser treatment during pregnancy is the management of the plume, especially in laser hair removal and ablative procedures. Electrosurgical and laser plumes are known to include a multitude of potentially harmful substances and infectious particles.[2,9,38] Although plumes have not been shown to be harmful to a human fetus, there is some evidence of teratogenicity in rats.[9,38] Until more information is available, it may be prudent to use N95 masks and sufficiently powered smoke evacuators with a HEPA filter and a velocity of 30 to 45 m/min held within 5 cm of the treatment area during laser hair removal or ablative treatments.[38]

Decreased or prolonged healing, hyperpigmentation, and scarring all have been reported to be worse or more common in pregnant patients although the evidence supporting these claims is limited.[2,8,39] Nevertheless, these issues must be considered and discussed when deciding on laser treatments during pregnancy.

This systematic review was limited by the number and low level of evidence of available reports published on fetal exposure to lasers. Among those reported, none of the studies evaluated the fetus into adulthood. The best evidence exists for the safety of the carbon dioxide laser, particularly in the treatment of condyloma.

Conclusion

The utilization of laser therapy in the treatment of the gravid patient has, to date, demonstrated no significant risk to a human fetus during any trimester of pregnancy, at least as reported in the available literature and a legal review. The notable effects were a single episode of PROM without further morbidity and several cases of premature contractions without development of true labor, possibly due to the prophylactic use of tocolytics in some of these cases. This review examined reports encompassing several of the

laser wavelengths used or similar to those used in dermatologic surgery. It is likely intense-pulsed light (IPL) procedures would have a similar safety profile to the lasers studied, although no reports specific to IPL exist to support or refute this claim. An examination of the scientific principles of laser penetration into tissues and selective photothermolysis also suggests that a variety of visible and infrared spectrum lasers should not have any potential to impact a fetus directly; however, evidence to support this clinically is limited. The second trimester demonstrates the lowest theoretical risk of maternal fetal compromise, but the data here have failed to demonstrate increased risk of morbidity in any trimester. The use of specific topical anesthetic preparations seems to be safe in pregnancy and may potentially decrease concern for fetal stress secondary to maternal stress or pain during the procedure. Appropriate safety measures including eye protection and laser plume management should continue to be used during laser treatment.

Given the cumulative evidence presented, the guidelines for the use of laser treatments in gravid patients should be modified to reflect the observed safety profile. To date, there has been no reported significant harm to mother or fetus due to laser therapy during any stage of pregnancy. Although it is possible not all adverse events have been reported, the available information demonstrates a high level of safety in cutaneous laser treatment using a variety of visible, near-infrared, and infrared wavelengths in all trimesters of pregnancy.

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