COMMENTARY

Ergonomics in Dermatologic Laser Procedures

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Due to working in static positions and use of repetitive movements over long periods of time, dermatologists are at increased risk of work-related musculoskeletal injury. Historically, studies on procedural ergonomics have focused on dermatologic surgery, however, laser procedures can also have a significant cumulative effect on physician posture. Here, we aim to highlight ergonomic challenges specific to dermatologic laser procedures and suggest areas of improvement in operating room organization, patient positioning, physician mechanics, and instrumentation. For the operating room, it is beneficial to store several devices in the same room, have central placement of electrical outlets, and to position the devices on the same side of the bed as the laser operator. When considering patient positioning, a Trendelenburg bed position can be helpful for vascular lesions on the head, and frequent repositioning of the patient can prevent uncomfortable bending of the operator and laser arm for circumferential lesions. Physicians should maintain a working position with a neutral spine and wrist position, moving the patient and bed as needed to reduce muscle tension. Lastly, laser instrumentation in the future could be improved upon with lightweight consoles and hand pieces, long multi-articulated device arms, and lightweight laser goggles with adjustable head straps. With the use of organizational, ergonomic positioning, and teamwork strategies, we can reduce the risk of musculoskeletal injury for our laser operators. **KEYWORDS:** Ergonomics, musculoskeletal injury, dermatology, laser

Ergonomics is a subject of growing interest to prevent musculoskeletal injury (MSI). Dermatologists are at increased risk of MSI in the neck, back, and shoulders due to using repetitive movements and working in static positions for long periods of time.[1] While the study of ergonomics has classically focused on surgical settings, this practice in laser procedures should not be overlooked. Laser procedures, although individually short in duration, can be numerous and have a cumulative effect on physician posture. While surgical ergonomics must account for physician mechanics and patient positioning, laser ergonomics must also account for an often large and potentially dangerous device. Given laser positioning is crucial to proper treatment, ergonomics can suffer to maintain accuracy, thus leading to deleterious long-term effects and risk of MSI. Here, we aim to highlight ergonomic challenges in dermatologic laser procedures and suggest areas of improvement (Table 1).

Operating room layout and organization. Economy of space is important for dermatologists who offer energy-based treatments. Devices can be large and heavy, so transferring between rooms is a physical challenge and risks equipment damage. Furthermore, many treatment plans include combinations of multiple devices. Therefore, keeping several devices within one room can be beneficial, although this requires communication on proper goggle usage when switching between lasers. Performing a time-out before procedures to confirm all have the correct protective eyewear is recommended. Another consideration includes centralized placement of electrical outlets to minimize cords extending across the room to diminish risk for tripping. In addition, there should be space for the device close to the patient's chair to allow proper positioning of the articulated arm or fiber.

Patient positioning and physician mechanics. Patient position is dictated by the treatment location, lesion type, and device utilized. For example, vascular lesions should be positioned dependently to increase blood flow and maximize the target chromophore. This often requires Trendelenburg positioning for lesions of the head and neck, a strong argument for examination chairs with this capability (Figure 1). For widespread or circumferential limb treatments, frequent patient repositioning (while maintaining patient comfort) for optimal access is preferred over physician bending and twisting (Figure 2). For infant cases, swaddling patients gently but firmly reduces movement and ensures that the child does not disrupt eye protection. The use of general anesthesia that necessitates patient intubation also poses a challenging position constraint. In such cases, multiple assistants may be necessary for turning the patient. Teamwork with a well-trained assistant blotting or holding pressure (for procedures such as erbium:yttirum aluminum garnet ablative resurfacing), operating the

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TABLE 1. Tips for improving ergonomics in dermatologic laser procedures

Operating room layout and organization	Store several devices in one room*
	Position devices on the same side of the bed as the operator
	Power outlets and cords in a single, centralized location
	Keep device at a distance that allows for fluid, articulated arm movement
Patient positioning	Trendelenburg bed position for vascular lesions on the head/neck
	Frequent repositioning for circumferential lesions
	Swaddling or parent assistance for infants
	Multiple assistants to help with patients under general anesthesia
Physician mechanics	Maintain a neutral spine with head centered over shoulders and chin tucked, with shoulders back and centered over the hips
	Maintain neutral wrist position and move patient as needed
	Stand on the operator's dominant hand side of the bed
	Sit if multiple operators of different heights
	Neck and shoulder stretch breaks between cases
Instrumentation	Lightweight device consoles
	Long device arms with multiple articulations
	Lightweight and comfortable hand pieces
	Goggles with an adjustable head strap

*Use caution when storing several devices in one room, as this can cause confusion regarding which goggles should be used

smoke evacuator and external cooling device, and applying topicals or ice as needed can improve efficiency and reduce ergonomic stress on the primary provider.

The necessity of keeping the laser handpiece at 90° in relation to the skin's surface creates a temptation to bend at the back and crane the neck when treating widespread lesions. Laser operators must make a conscious effort to frequently adjust the patient's position while maintaining a neutral spine to prevent MSI. Standing/sitting on the patient's right when right-handed (or the patient's left when left-handed) allows for a more neutral wrist posture at the bedside. Furthermore, proper mechanics include having the bed at a height that allows for the laser operator to keep their head over their shoulders with chin tucked, with their shoulders back and centered over the hips.[1] If multiple laser operators or assistants are present, sitting in adjustable chairs may allow

FIGURE 2. Patient repositioning for circumferential limb lesion (a-b)

FIGURE 1. Trendelenburg position for facial vascular lesion

proper position at the bedside for operators of different heights. Lastly, the use of anti-fatigue mats can help when standing during long cases and regular breaks to stretch the neck/shoulders between cases can reduce muscle strain.

Instrumentation. The ergonomic design challenges of laser devices are well known to dermatologists, with heavy fiber tracts that should not bend and articulating arms which can be difficult to manipulate. While articles from the urology and otolaryngology literature evaluate ergonomic designs of invasive laser devices, there are no comparable dermatologic studies. This is an opportunity for future research. Rogers et al[2] set forth general ergonomic goals of laser design from the surgeon's viewpoint. Desired features included consoles that are small and lightweight; laser arms that are long with multiple articulations to accommodate contours; and comfortable, lightweight hand pieces to reduce fatigue and improve accuracy.

The ergonomic designs of laser protective equipment should also not be overlooked. Heavy goggles can cause forward strain on the cervical spine and impair performance. This was demonstrated when anesthesiologists wearing laser protection goggles showed increased errors and time needed to perform simple tasks.[3] Laser operators should individualize goggle design choice when possible or use adjustable behind-the-head straps.

Beyond mechanical design, there have been technological advances in laser-interfacing computers to reduce physical workload. Wang et al[4] investigated a computer mapping system for automated photodynamic therapy of port wine birthmarks. The technique was found to be safe, effective, and relieved the laser operator of fatigue and ergonomic strain.[4] Similarly, Wilczynski et al[5] described image-guided automatic triggering of fractional CO_2 laser with cameras tracking the skin surface. This technology reduced side effects and total treatment time in aesthetic procedures.

CONCLUSION

Ergonomic considerations specific to laser therapy heavily rely on device and equipment design. Further studies are needed within the dermatologic literature to describe the current challenges and provide feedback to improve designs. Nevertheless, there are immediately available organizational, positioning, and teamwork strategies that should be implemented to reduce the risk of MSI.

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