Safety Principles in the Application of Lasers in Energy-based Aesthetic Procedures from the Nurse's Perspective

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Recently, various lasers and energy-based devices (EBDs) have been widely used in aesthetic procedures. Although using lasers and energy-based aesthetic procedures presents a potential risk to doctors, nurses, and patients, aesthetic procedures tend to be performed without the necessary precautions. For injury prevention, it is essential to follow safety rules and be aware of potential accidents. Furthermore, it is important to understand the basic principles of the devices, including the different optical and electrical properties. Acquiring the exact knowledge to control a device is important for two reasons; to maintain a safer operating environment and prolong the lifespan of expensive devices. This review briefly summarizes the knowledge needed for better and safer aesthetic procedures and the proper control of aesthetic devices.

Key words

Aesthetic devices; Safe operation

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INTRODUCTION

The personnel administering procedures using aesthetic devices [lasers or energy-based devices (EBDs)] varies slightly from country to country but is almost entirely physicians. Therefore, from a clinical view, it is important to maximize treatment effects and reduce side effects.^{1,2} However, from the nurse's point of view, other things could be considered. The prevention of physical damage (especially eyes and airway) of the patients and medical staff, post-procedural care, maintenance of the device and performance standards, and keeping the operating room environment safe are the responsibility of nurses.^{2,3} Therefore, nurses need essential knowledge of the procedure and devices. Unfortunately, there are few programs in Korea that systematically educate nurses on these topics. Considering the number of aesthetic procedures performed annually in Korea, it is desirable to conduct regular education through an authorized institution for all medical staff.^{3,4}

EYE SAFETY

Among aesthetic devices, eye protection is most important in laser procedures. Lasers are classified according to the level of risk, and all lasers used in aesthetic procedures were classified as grade 4, which means they can cause serious eye damage.^{5,6} Other devices (radiofrequency or ultrasound devices) except lasers have relatively less effect on the eyes, but none are completely safe, especially in procedures in the periorbital area, in which

direct corneal damage can develop.⁷ In laser procedures, the wavelengths used vary with the type of devices and each wavelength causes different damage to the eye. Lasers using ultraviolet and infrared wavelengths can cause damage to the corneal region. Visible light lasers can penetrate the retina, so eye protection is essential. Many blindness accidents have been reported from the use of lasers in this wavelength range.^{7,8} The eye protection must block the light from the laser as much as possible.

Special eyeglasses or lens-type protective devices are commonly used for protection (Fig. 1). During laser procedures, it is necessary to secure a clear view and also protect the doctor's eyes. Thus, specially designed safety glasses are required. Each pair of safety glasses has its own properties and block wavelengths in different ranges (Fig. 2). The degree of light penetration is indicated by an OD ratio, which is the proportion of the whole laser transmitted through the eyes. Good safety glasses have a sufficient OD value, provide a good view during the procedure, and block the laser from the lateral sides.⁹

AIRWAY SAFETY

Harmful plumes and small dust particles may be generated during aesthetic procedures. A mask is the primary and most important tool for airway protection and an N95 or N94 mask is recommended.^{9,10} In addition, suction with a large radius and strong suction power, or central ventilation equipment or large-capacity air purification electronics like those commonly used in operating rooms are recommended (Fig. 3).

Fig. 1. Devices for patient's eye protection. (A) Goggle-type eye protection device. (B) Contact lens-type eye protection.

Fig. 2. Laser-specific safety glasses. Different glasses must be prepared for each laser device of a particular wavelength.

OPERATION ROOM SAFETY CHECKLIST

Making an operating room suitable for using aesthetic devices requires many more precautions than a regular operating room. Here are an essential checklist and an explanation.

1) Remove reflective mirrors or metal in the operating room.³⁻⁵ Any reflective materials must be removed from the wall and ceiling to protect the eyes. Especially when using lasers, numerous cases of ocular damage by reflected light from lasers have been reported. It is also important to educate patients to remove reflective accessories before the procedure.

2) It is recommended to install a signboard to notify that the device (especially lasers) is being used during the procedure.¹¹ Furthermore, hanging a black curtain just behind the entrance is recommended as a double safety feature [Fig. 4].

3) Most aesthetic devices can generate high energy and

Fig. 3. Various devices for airway safety during aesthetic procedures. (A) Air-purifier. (B) Large and powerful suction device is required in an operation room. (C) Central ventilation system in an operation room. (D) Suction devices.

are vulnerable to fire. Therefore, flammable materials in the operating room should be eliminated. Disinfectants, such as alcohol and dressing materials commonly used in hospitals, should be strictly prohibited while aesthetic devices are in use [Fig. 5].^{3-5,12} In addition, because the patients may be wearing flammable beauty products, it is important to educate them to completely remove these products before the procedure.

4) Position-changeable surgical beds and efficient surgical lighting devices are essential. As most aesthetic procedures are performed wearing safety glasses, more intensive light is needed than in other surgical procedures. In addition, the handpieces of most aesthetic devices are heavy and stiff. Therefore, the position of surgical beds must be able to change depending on the patient's posture for a comfortable procedure. This will reduce musculoskeletal problems of the medical staff during repetitive procedures.¹³

LONG-TERM USE OF DEVICES

Most devices used in aesthetic procedures are expensive, so it is very important to keep them operating properly for as long as possible. 1) Most aesthetic devices are based on optical and electrical energy, so they are vulnerable to various types of dust.¹⁴ Therefore, it is essential

to regularly clean the lens or the inside of the handpiece. 2) Aesthetic devices, especially lasers, require very high voltages to operate. Therefore, it is recommended to install equipment to efficiently maintain high voltage in order to use multiple devices in the operating room. It is also necessary to connect each device to a separate power source. The use of multi-taps should be avoided as it can cause electrical problems [Fig. 6]. 3) If the device

Fig. 5. Flammable disinfectants and dressing materials must be restricted.

Fig. 4. Warning signboard and black curtain.

Fig. 6. Electrical safety for aesthetic devices. (A) Modulator for stable voltage. (B) Limiting the connection of many devices in one power supply.

generates excessive heat, the durability of the device is impaired. It is very important to replace the water in the cooling well, adjust the overall temperature of the operating room, and install the device away from the wall so the fan in the rear of the devices is not blocked. 4) Aesthetic devices can be damaged by movement. Moving the device during procedures cannot be avoided, but it is very important to move as slowly and smoothly as possible.

CONCLUSION

Treatment with aesthetic devices is expected to gradually increase in the future. Successful aesthetic procedures do not just mean outstanding medical effects, it should also include safe and economic considerations. Therefore, in the aesthetic market, the role of nurses who manage devices and assist in the procedure has become more important. Nurses and doctors should be fully informed of basic operating knowledge, adverse effects, and safety principals of aesthetic devices and how to prepare aesthetic procedure rooms.

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