

## Clinical Reports

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### Safety Clip for Endotracheal Tubes

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Anesthesiologists and others involved in airway management daily confront the possibility of mechanical disconnection of a patient from a ventilator or other breathing apparatus. For obvious reasons, statistics concerning the incidence of this problem are not readily available.

Several safety devices have been developed. A few examples include a ventilator disconnect alarm,<sup>1</sup> an oxygen-failure safety device,<sup>2</sup> and an inspiratory safety valve.<sup>3</sup> However, in the recent medical literature, only one device that deals with the prevention of disconnection has been described.<sup>4</sup> This device necessitates modification of an anesthesia or ventilator Y-piece.

We describe two simple devices, developed at our institution, that have proven effective in the prevention of disconnection of endotracheal tubes from both anesthesia and other mechanical ventilators. These designs are adaptable without the modification of many commercially available Y-pieces and adaptors. They allow firm connection with all standard 15-mm endotracheal tube adaptors.

Figure 1 shows an arrangement of a simple clip-on device made of type 304 hard-drawn, spring-tempered stainless steel wire 1 mm in diameter. A 15-cm spring, 2.5 mm OD, 0.5 mm in diameter, made of type 304 hard-drawn, spring-tempered stainless steel wire is

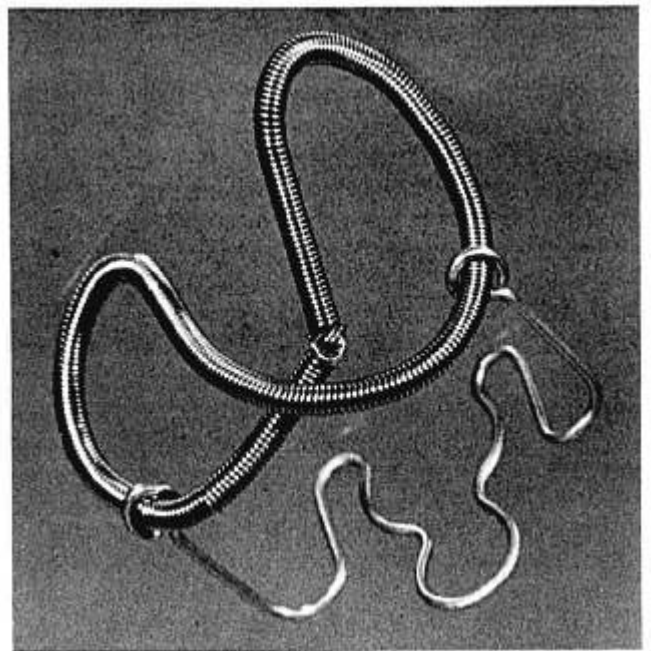


FIG. 1. Safety clip for use with most Y-pieces.

passed through loops on the clip-on device. The spring is joined end-to-end with interlocking loops, which are bent at right angles to the coils. Once they are together, a figure of eight that will allow placement over most Y-pieces is easily formed.

Figure 2 demonstrates use of the device with a commonly used anesthesia Y-piece. Figure 3 shows a variation of the device shown in figure 1. It is fashioned from type 304 hard-drawn, spring-tempered stainless steel wire 0.75 mm in diameter.

Because of the simplicity of the basic design of this safety device, we have found it easily modified to complement most types of Y-connectors and other adaptors.

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FIG. 2. Y-piece safety clip in use.

In addition to the stated advantage of preventing disconnections, the possibility of some adverse effects from these devices has been considered. The most serious potential problem is inadvertent removal of endotracheal tubes. Damage to equipment, injury to patients, and failure of these safety clips to perform their stated function are possible hazards.

In the laboratory, stability and efficacy were tested by the application of vibration and tensile forces to arrangements of the safety clips that mimicked their clinical application. Clinically, testing was performed during more than a hundred operations. The majority were neurosurgical, oral-facial, and head-and-neck procedures in which draping and positioning posed problems of access to the patients' airways. The use of craniotome and burr-hole devices during neurosurgery provided sufficient vibrating stresses to test stability. In addition, the use of an osteotome device with bone manipulation during ramusotomies in prognathic and retrognathic patients placed significant vibratory and tensile stresses on the safety clip assemblies.

Results of the testing have verified the efficacy of the safety clips. Tolerance to stresses that exceed those

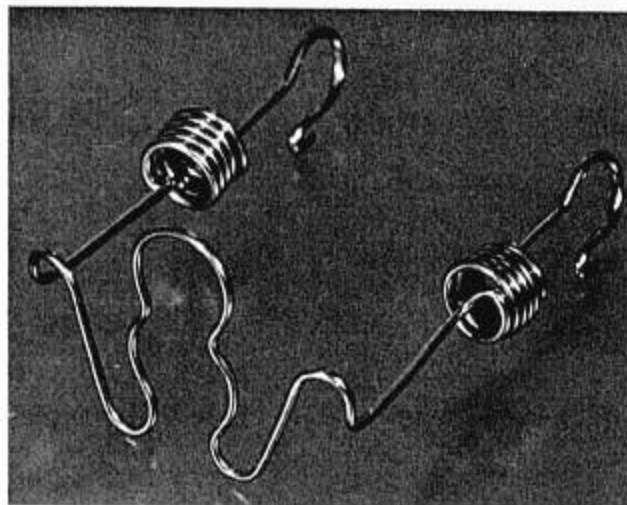


FIG. 3. Safety clip modified for use with Y-piece adaptor.

normally experienced during clinical use has been found. Physical damage to associated anesthesia equipment and injuries to patients were not observed. To date, we have not found mechanical disconnections from or accidental removal of endotracheal tubes, which have been secured to patients with adhesive tape, while using the safety clips. As with the use of any device, common sense should always prevail. There is no substitution for careful and continued observation of a patient during the administration of anesthesia.

In summary, we have presented a description of two safety devices that may prove of value in preventing disconnections of endotracheal tubes from various types of ventilation systems. These items can be fashioned, by skilled personnel, from readily available raw materials, as described. An application for patent rights by Cornell University is currently in progress.

#### REFERENCES

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