A Novel Needle Structure that Can Avoid Intravascular Injection of Any Filler

Hsiang Huang, MD*  
Yu-Shan Lin, MD, PhD†

**Summary:** With increasing use of dermal fillers, more and more adverse effects are reported. The most devastating one is intravascular injection. We propose a novel needle prototype that allows physicians to prevent intravascular injection. (Plast Reconstr Surg Glob Open 2017;5:e1285; doi: 10.1097/GOX.0000000000001285; Published online 20 April 2017.)

**INTRODUCTION**

With the increasing use of dermal fillers, many complications have been reported; the most serious of which is intravascular injection, which may cause skin necrosis, blindness, or stroke.

To prevent intravascular injection, many practices have been attempted, including ensuring appropriate injection depth, aspiration before injection, or use of cannulas. Aspiration before injection is not completely safe because successful aspiration is achieved only with the proper gauge size for different fillers. No method is 100% safe during the injection process, because it is difficult to determine the precise position of the tip and distinguish whether it is inside the vessels or not.

Therefore, we propose a novel needle prototype that allows physicians to know the exact location of the needle during injection and prevent intravascular injection and its complications.

**Mechanism**

During the collection of blood samples from the veins, the tip of our needle penetrates the wall of a vessel and the lumen. The human body has natural blood pressure in the veins and arteries. When the needle tip is inside the vessel lumen, the blood will flow into the inner cavity of the needle and fill the chamber because of the blood pressure difference between the chamber and the vessel. Therefore, it is possible to observe blood inside the chamber and know whether the needle tip is inside the vessel lumen. Subsequently, the syringe and tip are joined to draw the blood sample.

**Fig. 1.** Cross section and side view of the double-chamber needle. Chamber for filler (A); needle lumen for filler (a); chamber for blood (B); needle lumen for blood (b).

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The novel prototype needle that we are proposing has 2 separate and independent needle lumens [(a) and (b)] connecting to 2 different independent chambers [(A) and (B)]. Needle lumen (a) is for the passage of the filler and lumen (b) is used for detecting the position of the needle tip. With regard to the chambers, chamber (B) has an open window (Fig. 1). The rationale behind this design is that when the needle tip taps the vessel and enters the blood vessel lumen, because of the natural pressure within the vessel, blood will enter needle lumen (b). This can be observed by the physician in chamber (B). (See video, Supplemental Digital Content 1, which demonstrates the tip of the novel needle entering the blood vessel. Blood can be observed by the physician through the chamber, http://links.lww.com/PRSGO/A405.) The mechanism is similar to that of phlebotomy. Hence, with this novel needle, physicians can be aware of the tip position when it is inside the vessel lumen. Thus, intravascular injection can be avoided, preventing many complications. During the injection, the window in chamber (B) can also be closed to prevent filler influx into needle lumen (b). The needle works well both as a sharp needle and as a blunt cannula (Fig. 2). (See video, Supplemental Digital Content 2, which demonstrates the use of the novel needle as a sharp needle for filler injection, http://links.lww.com/PRSGO/A406.) Therefore, this allows the physician to feel comfortable and safe during the injection. With this novel needle, accidental intravascular injections can be avoided.

**DISCUSSION**

Real-time monitoring of the position of the needle tip outside or inside the vessel is crucial for physicians during injection of fillers. This prototype provides a new tool for distinguishing the position of the needle tip during injection. This instrument needs more investigations to further illustrate its safety and efficacy profile. Nevertheless, this needle may help in decreasing and avoiding the incidence of intravascular injections. Many patients will benefit from this innovation.

**REFERENCES**

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