

## Snakebite Suction Devices Don't Remove Venom: They Just Suck

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It was only a few decades ago that incision and suction were recommended snakebite first aid. However, concerns arose about injuries and infections caused when laypersons made incisions across fang marks and applied mouth suction. Meanwhile, several snakebite suction devices (eg, Cutter's Snakebite Kit, Venom Ex) were evaluated, and it was determined that they were neither safe nor effective.<sup>1</sup> So, recommendations changed, and mechanical suction without incision was advocated instead.<sup>2-5</sup> It seemed intuitive that suction alone would probably remove venom and should not cause harm. However, when the techniques were studied rigorously, quite the opposite was discovered.

One of the most popular suction devices, the Sawyer Extractor pump (Sawyer Products, Safety Harbor, FL), operates by applying approximately 1 atm of negative pressure directly over a fang puncture wound (or wounds) without making incisions. The manufacturer instructs that the device be applied within 3 minutes of the snakebite and left in place for 30 to 60 minutes. For many years, most agreed (including the Wilderness Medical Society and the American Medical Association) that the Extractor might be beneficial and would probably cause no harm.<sup>2-5</sup> Others suggested that it could exacerbate tissue damage, adding insult to injury after viper envenomation.<sup>6-9</sup> In this issue of *Annals*, the Extractor's inefficacy has been further confirmed with a well-designed study and fully detailed manuscript.<sup>10</sup>

In their prospective experimental trial, a human model was used to test the amount of radioactively labeled mock venom that could be removed by an Extractor after subcutaneous injection with a 16-gauge hypodermic needle. The investigators measured radioactive count as an approximation of the amount of venom removed. The bottom line: the Extractor removed 0.04% to 2.0% of the envenomation load. The authors conclude that this is a clinically insignificant amount and that the Extractor is essentially useless. The main limitation of their study is that they could not use real venom.

The study by Alberts et al<sup>10</sup> corroborates other studies that have tested the efficacy and safety of the Extractor. Using a porcine model and real rattlesnake venom in a randomized, controlled trial, Bush et al<sup>11</sup> measured swelling and local effects as outcome variables after application of an Extractor to artificially envenomated extremities. The conclusion of the study was that the Extractor did not reduce swelling, but resulted in further injury in some subjects. Specifically, circular lesions identical in size and shape to the Extractor suction cups developed where the devices had been applied. These lesions subsequently necrosed, sloughed, and resulted in tissue loss that prolonged healing by weeks. Similar injuries after Extractor use have been noted in human patients.<sup>1,12</sup>

In another study, Extractors were applied to 2 human patients immediately after rattlesnake envenomations, and the device was left in place until its cup filled with serosanguinous fluid 5 times, although the authors do not specify the volume(s) of fluid obtained. The concentration of venom was measured in the fluid removed using an enzyme-linked immunosorbent assay.<sup>13</sup> There were no control subjects, and this study has only been published in abstract form. Ironically, this abstract is cited amongst the main supporting evidence for the Extractor.<sup>4,14</sup> However, a closer review of the results reveals that the concentration of venom in the serosanguinous fluid removed was only about 1/10,000th the concentration of rattlesnake venom. Alberts et al<sup>10</sup> similarly noted that although a relatively large volume of bloody fluid was pulled from the puncture site, it contained virtually no venom. Most interestingly, Alberts et al found that the amount of venom

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in the fluid that spontaneously oozed from the wound was greater than the amount of venom in the Extractor aspirate. It is possible in these 2 experiments that the fluid obtained came from superficial tissues, and that the strong suction exerted by the device collapses the distal portion of the fang tract where the venom is deposited, thereby reducing the amount of venom that would spontaneously ooze out. This suggests, like the study by Bush et al,<sup>11</sup> that the Extractor might make the envenomation worse by paradoxically increasing the amount of venom left in the wound.

Although each of these 3 studies was done independently of each other and using different methodology, they arrive at the same conclusion: the Extractor does not work, and it could make things worse. The only study that suggests the Extractor removes a clinically important amount of venom is an uncontrolled experiment using a rabbit model.<sup>15</sup> Unfortunately, this study was only published as an abstract, and the methodology is not described in detail. Furthermore, its results are suspect for many reasons. Rabbits have a very thin subcutaneous layer, unlike humans (and pigs).<sup>16</sup> Most snake envenomations are thought to occur in the subcutaneous layer.<sup>17</sup> It is possible that in Bronstein et al's<sup>15</sup> investigation the injected venom collected just under the rabbit's skin, where it was easily suctioned back out by the device. Because this inadequately documented single abstract reports a finding that is vastly different from all the other studies that follow, its conclusions are questionable and may be erroneous.

If there was controversy before, the study by Alberts et al<sup>10</sup> adds to the growing pile of evidence against the Extractor. This study should change our practice. We should stop recommending Extractors for pit viper bites, and the manufacturer should certainly stop advertising that they are recommended medically as the only acceptable first aid device for snakebites.

Because it is becoming clear that this gadget does not work, future investigations should focus on other first aid techniques, such as pressure-immobilization or others yet to be discovered. Meanwhile, the best first aid for snakebite is a cell phone and a helicopter.

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