Development of an Automated Laser Debridement System for Cutaneous Injuries

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The initial step in the repair of a thermal or chemical burn is wound debridement, the removal of the dead skin covering the burn. Afterwards, the exposed wound is covered with a viable biological dressing, the scabs re-form and the process must be repeated until the wound is fully healed. Of the various methods of wound debridement, surgical excision is the most popular. The process uses stainless steel cutting blades mounted on different types of handles which have built-in adjustments for controlling the depth of the excision. The main problems with this treatment method are excessive bleeding and lack of high-precision control of the cutting depth. Recent advances have been made in healing treatments for thermal and chemical burns using a variety of techniques to debride damaged tissue, including the use of medical lasers, such as CO2 and Er:YAG lasers. Excision using laser beams has been shown to be associated with significantly reduced morbidity, since the amount of blood lost during debridement is significantly reduced because the depth of treatment is more precise and the process has a cauterization cycle built-in. One drawback to the available laser systems is that they all require the surgeon to move a hand piece over the damaged area. This process requires great operator skill and is time consuming for an injury with a large surface area. Small hand held scanners attached to the end of articulated arms have mitigated this drawback to some extent, but the scanned areas are relatively small and the surgeon still needs to move the scanner head over larger injuries. This project describes the development of an automated, 3D vision guided laser debridement system with a large maximum working area for efficiently treating injuries with large areas or a multitude of smaller injuries distributed over a large area. This system is designed to be fail-safe, and performs precise debridement automatically and quickly with minimal surgeon involvement.