WOCA A battery powered wound pump designed for use in low-resource settings

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WOCA

A battery powered wound pump designed for use in low-resource setting

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SYNOPSIS

Vacuum-Assisted wound care (VAC) is effective for treating complex wounds, but is hardly available in low-resource settings. An affordable, portable and safe VAC device was developed to treat patients with chronic and complex wounds: the Wound Care (WOCA) Pump. The WOCA safely controls the pressure accurately (+/- 10%) between -70 and -125 mmHg for a total component cost of USD 150. In this research important steps were taken to make VAC therapy more accessible, affordable and safe for marginalised patients in low-resource settings. Next research will aim to assess its safe clinical use.

Figure 1: Design context. International Nepal Fellowship (INF), Green Pastures Hospital (GPH), Pokhara, Nepal

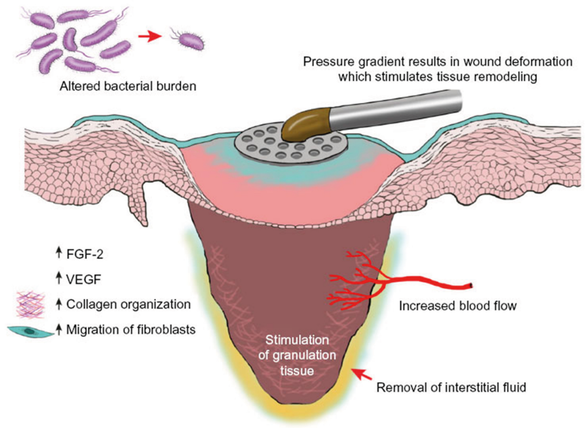

Figure 2: Negative Pressure Wound Therapy (NPWT) beneficial effects.

INTRODUCTION

In Low-Middle Income Countries (LMICs) the prevalence of complex wounds is alarmingly high. Complex wounds have a significant impact on the health and quality of life of the patient and their families. Vacuum-assisted wound closure (VAC) is a widely used treatment in the developed world to treat chronic and complex wounds. However, due to the high costs and low availability of the commercially available devices, VAC therapy is not a treatment option for many patients in LMICs.

AIM

The aim of this study is to develop a low-cost, portable VAC device to make the treatment more accessible for LMICs.

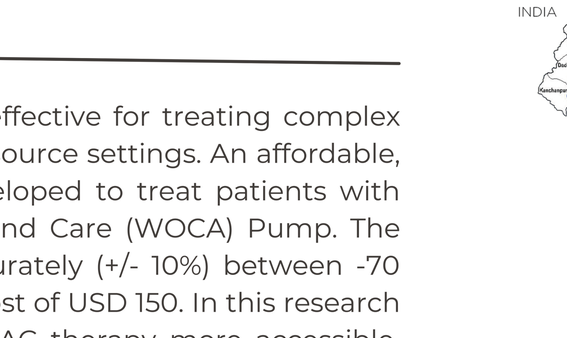

Figure 3: Current situation in the design context, using the AquaVAC.

METHOD

First, extensive context analysis, literature and expert review was done to compile a set of requirements and design guidance for the VAC device. Secondly, a conceptual design for a low-cost device was made, which meets all the requirements. Next, the conceptual design was transformed into a functional prototype in the Green Pastures Hospital (GPH) in Nepal. Finally, requirement validation was performed and a demonstration was given to the medical staff to evaluate additional wishes of the end-users.

Figure 4: Demo of the WOCA for the nurses at the Green Pastures Hospital

RESULTS

Analysis of the market:
Unnecessarily costly
Low-cost solutions lack reliability, safety and ease of use.

Wound Care (WOCA) Pump
Conceptual design

- Includes **automatic** pressure control
- **Compatible** with self-made dressings and standard canisters
- **Portable** design, battery last for 15 hours
- **Simple** interface, enables smooth operation & monitoring
- **Easy** to repair, consists of widely available, replaceable components

The conceptual design was transformed to a functional design and developed in the GPH. Features like automatic pressure control and safety alarms were added using Arduino Program-ming.

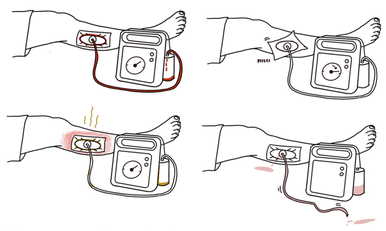

Figure 5: Safety concerns: 1. Pressure lost; 2. Bleeding; 3. Infection; 4. Tube blockeage/ tube disconnection.

Production costs: < 150 US Dollars
Compatible with inhouse made dressings of less than 1 USD.
The pressure can be set in a range between -70 and -125 mmHg and is regulated within the allowable margin of 10% of he set pressure.
The pump was able to overcome an air leak ratio of more than 1200 mL/min. The device includes a rechargeable battery that lasts for at least one therapy cycle (3-5 days). The components are available from local stores or can be delivered to the hospital from (local) online platforms. Furthermore, the housing can be printed with the 3D printer located in the GPH.

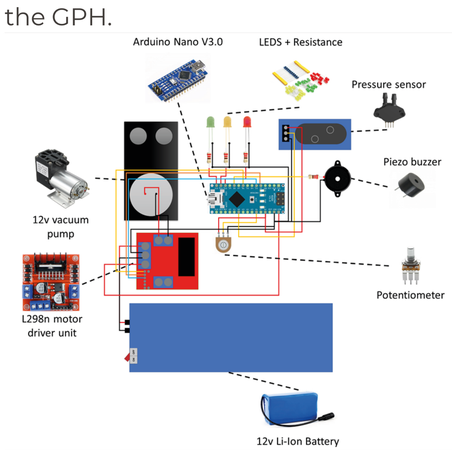

Figure 6: Electrical circuit design to power the vacuum device.

CONCLUSION

A functional, portable, simple and easy to repair VAC device has been developed. The WOCA Pump is made from widely available components, is compatible with self-made dressings, and can be developed for less than 150 USD. A clinical trial is being prepared to validate the safety and functionality of the next iteration of the device in the clinic. The development of the WOCA will provide a sustainable solution to make wound care more affordable and accessible in LMICs.

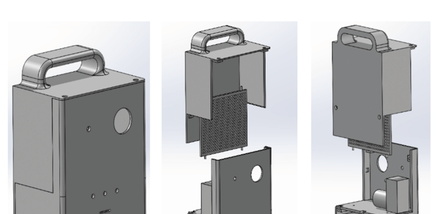

Figure 7: Functional design housing.

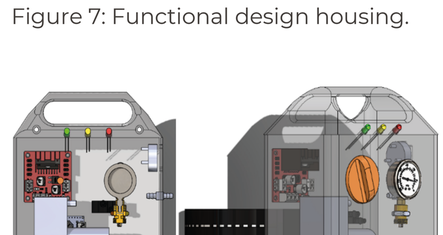

Figure 8: Arrangement of the components inside the housing.

FUTURE STEPS

- Design iteration
- Overflow protection system
- Safety optimalisation
- Durability testing
- ISO norm validation
- Clinical testing
  - WOCA vs AquaVAC
  - WOCA vs devices available from the market
- World wide local production

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