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DETECTION OF AIR LEAKAGE AT THE SKIN – EDGE OF THE MASK SURFACE WITH THE COMPONENT OF AUTOMATION IN BAG VALVE MASK

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Background: The study focuses on improving manual resuscitation bag valve masks (BVM) used in emergencies. Manual BVMs require skilled operation and face challenges like inconsistent ventilation and air leakage. The proposed solution is an automated BVM with air leakage detection at the mask's skin-edge surface. The research aim is the development of a bag valve mask that provides adequate ventilatory support during CPR with minimal air leakage via skin-edge of the mask surface.

Methodology: The methodology of the study involved a comprehensive literature review and identification of currently available bag valve masks (BVMs) and their technologies. Various reasons for air leakage were explored. Based on this, an updated BVM design was developed to address the identified challenges.

Deliverables: In our research, we aimed to automate BVM by using a mechanical setup that consists of a piston that compresses the bag, a rod that pushes the piston, and a crank plate that rotates to provide the linear motion for the rod and piston. A formula for the rotational speed of the crank plate was derived. The second and key portion of the research focused on making conceptual designs for addressing air leakage at the skin edge of the mask surface. One conceptual design involves incorporating capacitive pressure sensors into partitioned compartments within the mask cushion. Ceramic capacitive pressure transducers are utilized in compartments of 2.5 cm in length. The circuit board processes the capacitance changes and triggers LEDs corresponding to each sensor. The sealing force was also calculated. This comprehensive approach aims to reduce air leakage and improve the efficiency and effectiveness of BVMs during emergency resuscitation.

Conclusion: The study addressed air leakage in BVMs by calculating a 2N force needed for optimal mask fit, integrating 12 capacitive pressure sensors to detect and alert for air leakage. Future work includes developing a functional prototype for automated BVMs to improve ventilation in different requirements and CPR efficiency.

Keywords: Air leakage, Automated, BVM, ventilation, Sealing force.