The Development of an Alternative Exhalation Valve for Mechanical Ventilation by Additive Manufacturing

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The current Covid-19 pandemic has developed not only a global public health crisis, but also a very serious impact on production chains. Leveraged by the urgency of the scarcity of resources in public hospitals of developing nations, the objective of this project is to develop an alternative to a fundamental part of the mechanical ventilator, the exhalation valve, through 3D printing to reduce costs and production time, and using safe and sterilizable materials. From the materials studied in the first phase, the second phase proceeded with the experimental tests with PLA and HIPS. In the study of PLA, there was a need to search for a sterilization method compatible with its low thermal resistance, and HIPS needed an analysis of the results of its thermal tests to determine its best sterilization method. Both studies resulted in alternative methods of sterilization. The 3D prototypes of the analyzed materials were printed to test the feasibility of the printing process, sizing and design tests were also carried out in order to prove the effectiveness of the process, analyzing the accuracy of the result, which met the printing accuracy of 2.2% ± 1.8 mm. The PLA prototype reduced the cost of the part by 92% being produced in 14 hours, while HIPS reduced it by 74% being produced in 1-2 days. It can be concluded that both met the initial objective of developing a replacement alternative in an emergency context, in a safe and accessible way.

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