PROCESS DESIGN FOR AERATION OF FACIAL PROSTHETIC
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Abstract

Facial prosthetics are becoming a necessary step for the recovery of injured veterans and civilians who have suffered severe facial burning. Current users of such prosthetics are not able to wear the prosthetic for an extended period of time due to uncomfortable conditions created by the silicone material. A solution for this problem was to develop a process for creating small holes similar to skin pores that will both ventilate and aid in the evaporation of accumulated sweat under the prosthetic. The main steps of this process were to create a flexible fixture capable of supporting and securing the prosthetic during processing, creating a process for using a computer measuring machine to scan the varying and unique contours of the human face, and a process for converting the data into code that can be read by a CNC laser to create the holes. The approach for this project was to first design and fabricate the flexible fixture. The fixture consists of a stainless steel base connected and supported with steel rods and various connecting hardware. The top portion of the fixture is a plaster of paris mold that will be unique to each prosthetic and allows the flimsy silicone to be secured without unnecessary damage. The next process was to use a computer measuring machine (CMM) to record all contours of the prosthetic. To accomplish this, linear scans across the surface of the face were completed using a ball-probe taking measurements of its position across 100 points. The ball-probe measured 60 degrees to each side from the middle of the face, incrementing 1 degree for each scan. After the data was collected, an Excel program was used to convert the data into G-code that allowed the CNC controller to process the information. With the fixture

loaded into a 4th axis indexer, which allows access to all portions of the face, the final processing step using the CNC laser was completed. The CNC laser used the points measured from the CMM to position itself for each individual cut. The completed prosthetic was successful in increasing the airflow and ventilation but still requires further research to fully solve the problem. The overall process is sound but will require additional equipment for a fully completed prosthetic. One of the recommended changes is to use a more accurate measuring system such as conoscopic holography or a structured light 3-D scanner which will increase both the accuracy and efficiency of the scanning process. Another recommendation is to incorporate a 5th axis into the head of the laser to reach areas of the prosthetic that are too steep to reach using just a 4th axis. The current cost of both producing the fixture and running the processes is $1,523.96. This cost is justified because it represents less than 10% of the total current cost for a completed prosthetic.