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Improving lives in three dimensions: Feasibility of a 3D printing in creating personalized medical aids in a rural area of Sierra Leone

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Abstract

Aim: The aim of this feasibility study was to investigate how a 3D printer could be put to best use in a resource-limited healthcare setting. We examined whether a 3D printer can contribute to making prostheses, braces or splints for patients who underwent major limb amputation for complex wounds; e.g. due to burns and subsequent scarring, accident, conflict, or congenital abnormalities.

Methods: During a three-month period we investigated the benefits of customized, 3D printed arm prostheses, splints and braces in Sierra Leone. By using a handheld 3D scanner and a 3D printer, patient-specific medical aids were designed, manufactured and tested. Questionnaires regarding patient satisfaction and functionality of the prostheses were used during short-term follow-up.

Results: Four aesthetic prostheses were designed; two prostheses of the hand, one of the forearm and one of an entire arm. Follow-ups were conducted after three-to-four weeks to investigate the quality of the prostheses and to complete a patient questionnaire. Also, four splints for hands and arms were made to prevent scar contractures after skin transplantation. Finally, a brace for a 7-year-old boy with kyphoscoliosis was manufactured.

Discussion: The first prosthetic results were overly positive. Even though the prostheses fulfill aesthetic needs, they also exhibit some degree of functionality. For example, the prosthetic arm can provide support for the contralateral biological arm and participants seem to have more self-confidence when wearing the prosthesis. The boy with kyphoscoliosis has accepted the brace and will be followed-up in the months to come. Long-term follow-up is required to prove the sustainability of the 3D printed brace and prosthetic arms. Further research into how to sustain and refine the project is underway.

