A ONE-HANDED KNEE ASPIRATOR DEVICE TO AID IN ARTHROCENTESIS

THE SOCIAL DEVELOPMENT, USE, AND WASTE OF MEDICAL DEVICES

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SOCIOTECHNICAL SYNTHESIS

Health and medicine will impact and be impacted by each of us. Beginning at the clinical level, the technical research topic aims to improve procedure mechanics for physicians, while also decreasing discomfort and improving outcomes for patients. Through the creation of a medical device, this technical topic addresses the needs of different individuals affected by biomedical practices and technologies. Not only is the physical creation of a medical technology imperative, but also the understanding of why it comes to be. The science, technology and society (STS) topic provides a framework through which to analyze the social context of medical devices, and the many associated social groups and preferences. The tightly coupled technical and STS topics describe the process of creating a medical device, as well as the social considerations from a variety of groups who influence the design, use, and disposal of medical technology.

The technical report outlines the development of a medical device to improve the current procedure of fluid extraction from a swollen knee, known as arthrocentesis. The cumbersome mechanics of arthrocentesis result from the requirements of a physician to both hold and pull back a syringe, while simultaneously working the fluid sac in the knee. The proposed medical device attaches to a syringe to allow for ergonomic one-handed aspiration, and a free hand for fluid manipulation. This device was modeled using the computer-aided design software, Autodesk Fusion, and was 3D-printed in standard printing plastic.

Several prototypes were successfully printed of the mechanical version of the device, which functions using a bar-ratchet mechanism similar to that of a clamp spreader. While the device does move properly, the final iteration was unable to generate the necessary force to adequately extend a syringe. Additionally, due to time and resource constraints, the motorized

version of the model was only completed to a proof-of-concept phase. Neither model was completed for clinical testing.

The initial inspiration for researching the social context of medical devices in clinics came from the desire to understand what choices produce copious amounts of medical waste at healthcare facilities. The research then shifted towards answering the question of who is involved in the creation of medical devices, and how individual goals for a technology influence the formation, function, and eventual disposal of a device. Pinch and Bijker's Social Construction of Technology theory was used to create a framework outlining the necessary views and social groups that lead to and transform medical technology. The framework was developed through a collection of case studies, personal observations, and ethical readings regarding the rationale for interconnectedness of people and opinions in biomedical technological development.

Though the research was not solely used to explore why medical waste exists, the discussion of single-use versus reusable medical devices served as a platform to develop the socio-technological framework. This comparison helped to formulate the identification of economic, safety, and personal preferences of relevant social groups related to medical devices. Through the analysis, it became apparent that while issues held by different groups may overlap, such as device safety, their perspectives on how to address that issue can be contradictory. Overall, this research did not describe a solution, but instead provided a better understanding and appreciation for the individuals and interpretations that shape medicine and technology.

There are clear needs for medical devices, such as those developed for arthrocentesis. However, there are rarely clear paths for how to develop the technology, who should influence its form, and where it should end up. Medical devices are not merely a technical production, but a social construction.

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