Consultation:

Proposed regulatory scheme for personalised medical devices, including 3D-printed devices

- Submission by Griffith University -

Attention:

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BE REMARKABLE

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We kindly ask the TGA to contact the Senior Deputy Vice Chancellor & Senior Vice President of Griffith University, Professor Ned Pankhurst, for any questions relating to Griffith University's submission.

Prof Ned Pankhurst
Senior Deputy Vice Chancellor

[redacted]

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Introduction

The synthesis of electronic 3-dimensional imaging, computer-aided design (CAD) software, rigid and functional 3D models of the human body, and additive manufacturing with 3D printers has created a platform that enables the manufacturing of medical devices that are better fitted to a patient's neuro-musculoskeletal system, and have the potential to disrupt classical centralised manufacturing of medical devices and respective established logistic chains, by enabling local manufacturing of a host of medical devices.

Especially in orthopaedics and reconstructive surgery, there is a unique opportunity for digitally designed and 3D-printed surgical tools and medical implants to revolutionise the classical model of mass-manufactured one-fits-all orthopaedic implants.

In addition, the platform is utilised to produce a new type of model of a patient's anatomy, which can be touched, and is much more tangible than a 3D simulation, even than a virtual reality setting. Such models are used to better inform patients, to train medical practitioners and to help surgical teams to plan and prepare for surgery.

This platform is challenging traditional regulatory frameworks. Many countries are now considering new frameworks for the manufacturing of medical devices, especially 3D-designed and printed devices.

Griffith University has established an "Advanced Design and Prototyping Technology" (ADaPT1.0) test facility to host such a platform, which is utilised to develop and test advanced dynamic and function-focussed models of the human body, with applications in diagnostics, medical device development and rehabilitation. It also conducts early stage projects which aim at creating anatomical models for learning and teaching, and professional training purposes. As a next step, Griffith will construct the ADaPT2.0 facility in the emerging Gold Coast Health and Knowledge Precinct, next to the Gold Coast University Hospital, the Gold Coast Private Hospital and Griffith University's Gold Coast campus. ADaPT2.0 will be the space where Griffith University will apply its know-how and capabilities in functional 3D modelling, simulation, digitally enabled product design, advanced manufacturing and material research, in collaboration with the local hospitals and industry, and international partners. We expect the facility to be operational in 2021.

This industry-focused facility will be a place for rapid prototype development. For customers ADaPT will design prototype products that combine optimal functional characteristics of the right material with the best look and feel for end-users. A key activity will be the creation of functional models of the human neuro-musculoskeletal system. Such models will be high-fidelity tools that will allow diagnosis of neuro-musculoskeletal conditions, rapid design, functional simulation and fabrication of medical devices, surgery planning, and appropriate physiotherapeutic rehabilitation.

The University welcomes the consultation by the TGA relating to the regulatory framework for personalised medical devices, including 3D-printed devices, and wishes to contribute to shape the regulatory framework to become an effective enabler for personalised medical devices and point-of-care manufacturing of such devices.

With this submission, Griffith University would like to provide some comments and suggestions, with a focus on enabling software tools and advanced manufacturing, e.g. 3D printing.

[redacted]

Prof Paul Mazerolle,
Acting Deputy Vice Chancellor (Research)
Griffith University

Response to Questions

Griffith University is not producing medical devices. However, the University is engaged in prototyping and the development of platforms for the design and manufacturing of medical devices that are better fitted to a patient's neuro-musculoskeletal system.

Accordingly, Griffith responds in the following to the proposed regulatory amendments, rather than to the 6 questions of the Consultation.

Griffith does support the TGA's regulating personalised medical devices, especially the inclusion of 3D-printed devices.

However, some of the proposed regulatory amendments do not fully reflect the technologies and platforms utilised to design and manufacture personalised medical devices and could have some unintended consequences.

1. New definitions for personalised medical devices

Griffith appreciates adoption of the internationally harmonised definitions published by the International Medical Device Regulators Forum (IMDRF). However, the definitions "custom-made" and "patient-matched" are somewhat overlapping and therefore may not be sufficiently clear.

It can be argued that there is little difference between these types of medical devices as most patient-matched medical devices are matched based on specific design characteristics provided by a healthcare professional. Both kinds of devices can be produced utilising the same digital 3D design and manufacturing system based on the full anatomic features from patient imaging.

For example, surgical cutting guides have similar features, but need to perfectly match the anatomy of a patient. Are these "Patient-matched medical devices" or "Custom-made medical devices"?

3. Introduce a framework for regulating medical device production systems which will allow healthcare providers to produce lower risk personalised devices for treating their patients, without the need for manufacturing certification

We are wondering why healthcare providers are exempted from having to provide manufacturer assessment certifications to produce devices, including IIa devices, while industry is not exempt. We believe that the skills, design systems, production facilities and quality control systems required are found within industry, but typically not within a health institution.

There is the risk that this exemption is anti-competitive and detrimental to the emerging industry.

We reiterate similar to our 2017 submission to this topic

Typically, a health care practitioner would request e.g. a custom made medical device from a company and contribute a general specification of what is required to help a specific patient. Full design, production and finishing of a custom made medical device then would be done by a biomedical engineer, designer and technician in the company. Therefore, in almost all cases, a health care practitioner will not produce a finished medical device.

Also, there is no guidance, how the medical device production system would be validated.

The TGA also could provide training requirements and a certification process for non-health care professionals to enable them to produce finished medical devices with a validated medical device production system. From a health economics perspective, this will allow health care practitioners to focus on ensuring that their patient's needs are met without the burden of having to produce finished medical devices.

In addition, the TGA should provide guidelines and a process, how the medical device production system would be validated, tiered to the classification of medical devices the system is capable of producing.

4. Update the classification rule for medical devices that record diagnostic images so that it includes any device for this purpose and not just X-rays, for example 3D-printed models of patient anatomy

First, Griffith suggests that the scope of TGA's view of 3D anatomical models is too narrow.

3D Anatomical Models are

- both virtual and physical 3D representations;
- not used to "record diagnostic images", like x-rays films;
- created from a range of medical imaging modalities; and,
- going to be created from a combination of the patient's medical imaging and medical imaging population databases, e.g. using machine learning methods (e.g. for automated segmentation of bone, muscle and tendon).

The process of creating a 3D Anatomical Model exceeds by far just taking a medical image, e.g. an x-ray. The process has many steps that can affect the final virtual or physical model, i.e.

- correct selection of medical imaging modality;
- correct transformation of medical imaging to 3D digital rendering of patient and/or device;
- correct anatomical and physiological modelling of patient and/or device;
- correct virtual rendering of the intervention (e.g. surgical);
- correct virtual rendering of medical device and ancillary medical device;
- correct conversion of electronic data to an appropriate model that is prepared for and can be 3D printed; and,
- correct selection of materials, 3D printer, 3D print design (materials and structure) to obtain a "good" representation of the 3D human anatomy and physiology.

In addition, the use of 3D-printed models of patient anatomy is broader than for diagnosis or investigation of the anatomy, and includes planning of interventions and design of medical devices.

Second, Griffith suggests that there is a substantial difference between an unexposed x-ray film and a printed 3D model. An unexposed x-ray film is the raw material to record an x-ray image. An exposed and developed x-ray film is not considered being a medical device anymore. The same would apply to a digital x-ray photo. On this rationale, a 3D printed model is nothing else than a 3D representation of a stack of digital 2D x-ray photos. Thus, the unexposed x-ray film is a tool for recording of a medical image, while the 3D printed model is an outcome derived from a number of recorded medical images.

Accordingly, the classification of the physical 3D printed model as medical class IIa device seems not to be appropriate.

There is no equivalent to an unexposed x-ray film in 3D printing –classifying the powder or plastic granules use as raw material for 3D printing seems not to be appropriate, too.

On the other hand, the equipment utilised to record medical images, e.g. an x-ray machine, is a medical device, including the software.

Thus, would it make sense to classify the software used to accurately translate e.g. a stack of x-ray photos into a digital 3D model, the software to create a 3D printer file, and then the 3D printer as a

class IIa medical device? How can it be ensured that the model is an accurate representation of a patient's anatomy?

Third, a medical device production system could be used to manufacture 3D-printed models of patient anatomy. Taking this into account, there is again the risk that this leads to an anti-competitive situation that would be detrimental to the industry currently providing 3D-printed models of patient anatomy.

5. Regulate medical devices with a human origin component, for example a 3D-printed implant incorporating cells from the patient, as medical devices with a biological component rather than as pure biologicals

While Griffith is positive about this change, we reiterate our 2017 submission to this topic:

> There are several materials of human origin that can be included in a medical device. These include:
>
> - 'passive' biological scaffolds that provide bio-compatibility and/or bio-degradability, but no other functional benefits, and do not contain any allogenic components;
> - 'active' components, including growth factors and other mediators. Examples are growth factors included in a biological or synthetic scaffold that effect better biocompatibility, active integration, and/or colonisation of an implanted medical device by cells; and,
> - viable cells that mediate bio-compatibility and/or may provide additional functional features such as repair and integration.
>
> Any active and viable cellular components have enhanced risk, as they have the potential to functionally modulate the human body and potentially could act outside of the initial side of implantation of a medical device. Especially cells, as prime example for a viable human origin component, can migrate and/or proliferate within the human body, and thus cause undesired effects.
>
> Where such human origin components are derived in a non-personalised (heterologous) way, they also bear the risk of inducing immunologic rejection, due to potential display of allogenic immunogenic determinants to the host immune system.

The TGA's approach should take this complexity into account.