



3DMEDiTech™
Customised healthcare solutions

PROPOSED REGULATORY CHANGES RELATED TO PERSONALISED AND 3D PRINTED MEDICAL DEVICES

3DMEDiTech submission in respect of Therapeutic Goods
Administration consultation paper dated November 2017



CONTENTS

Overview	2
About 3DMEDiTech	3
Responses to proposals for regulatory change	4
Conclusion	9

Overview

3DMEDiTech welcomes the opportunity to respond to the TGA's consultation paper *Proposed regulatory changes related to personalised and 3D printed medical devices*, and looks forward to continuing our engagement with the TGA in relation to the issues contained therein.

3DMEDiTech supports the aims of the consultation and the goal of ensuring that the regulatory regime for 3D printing of medical devices is clear and maintains its currency in a rapidly changing technological environment. Given also that compliance with the current regulatory system is variable, 3DMEDiTech is keen to see both changes to the regulatory regime and more effective compliance to ensure that the regulations are being upheld.

A number of key elements outlined in the consultation paper are welcome and should be maintained and applauded as the regulatory environment changes and evolves. 3DMEDiTech particularly welcomes the acknowledgement of the changing nature of the 3D medical device printing industry as it moves from being comprised purely of small scale individual producers to increasingly incorporating customised production at scale and the risks inherent to patients and the public in this. Ensuring that devices manufactured at scale in this manner are registered with the Australian Register of Therapeutic Goods (ARTG) is important and 3DMEDiTech welcomes the intent to achieve this. The focus of the paper on the need to protect patient and community safety within this evolving environment is also welcomed given the changing risk profile that it engenders.

In addition to this, however, there is a need to recognise, honour and uphold the history and artisan nature of customised device manufacturing in some areas of health care and to protect those individuals who continue to create medical devices using the methods and materials in which they were originally trained and continue to use. Whilst production at scale is becoming more common and it is essential that the regulatory environment recognises this, the smaller scale producers who continue to pursue traditional manufacturing methods should not be crowded out of the market by regulatory change that fails to support their ongoing activity.

There are areas in which the consultation paper is not sufficiently clear or strong. 3DMEDiTech is aware that the essential principles governing the manufacture of customised devices are not always adhered to. 3DMEDiTech is of the opinion that establishing and maintaining an effective compliance regime as part of any regulatory changes is of critical importance in protecting patient and public health as well as confidence in Australian manufacturers of 3D printed medical devices. Compliance should therefore be a key priority in any regulatory change.

Concerns also exist in relation to other elements of the consultation paper. These include:

- The definition of the custom made device and the threshold for 'rare patient conditions or anatomy' (page 9); and
- The risk-based approach for manufacturers.

These concerns, on which more detail is provided within the body of this response, are informed by 3DMEDiTech's own experience in developing and manufacturing custom products and the requirement for multi-disciplinary expertise, such as software and material engineering as well as clinical oversight, in advanced manufacturing; and our deeply held concern for patients and understanding of the potential risks to them of insufficient regulatory protection.

3DMEDiTech is an outstanding example of the scale manufacturing of customised 3D printed devices that the TGA appears to be trying to capture and reflect in the proposed regulatory changes contained in the consultation paper. From our perspective, those changes could be strengthened further in order to effectively regulate our activity and that of the companies who will follow us.

About 3DMEDiTech

3DMEDiTech is a Melbourne-based company which aims to deliver world class customised 3D printed devices and manufacturing services at scale to the health sector across the Asia Pacific region.

Each medical device developed in preparation for mass customisation requires significant research and development. This includes mapping and interpreting the full spectrum of the clinical problem and the development and application of novel algorithms, as well as finding solutions to significant design, material and engineering problems.

3DMEDiTech has strong experience in 3D manufacturing technology and has a practice of extensive multidisciplinary collaboration of clinicians, engineers and technicians necessary to delivering excellence throughout both research and development, and product development.

The company has already completed product development and is in market with a number of Class I devices for prescription by dental clinicians (clear aligners); and orthoses for prescription by orthotist/prosthetists (such as plagiocephaly helmets, leg braces and ankle foot orthotics).

While our current devices are Class I, our Research and Development function has begun early work on Class II and III devices. 3DMEDiTech's clinical and research partners include Melbourne University, St Vincent's Health Australia, Orthokids, Ivoclar Vivodent and Eker.

While a proportion of 3DMEDiTech's Research and Development function is based in Israel, all of its end-use manufacturing occurs in a custom built clean room environment in Melbourne. 3DMEDiTech is currently working towards *ISO 13485:2016 Medical Devices – Quality Management Systems* certification, which should be complete in the first half of calendar year 2018.

3DMEDiTech's workflow is completely digital, as we only work with clinicians that have in place the latest digital scanning technology thereby enabling the fastest and most accurate design and delivery of customised devices to the end user.

3DMEDiTech aligns research and development expertise and experience with customised advanced manufacture at scale. It has strong IP understanding and linkages and its founders comprise industry veterans committed to ongoing growth and delivering strong outcomes for patients' health and wellbeing.

Responses to proposals for regulatory change

Proposal 1: New definition for personalised devices

Definitions

We note the new definition of custom made device being considered and generally support this as moving in the right direction.

Custom made devices manufactured at scale should however be recognised as different from the artisan products, particularly those produced by hand, by specialised providers of such devices, trained and practicing appropriately.

The changes recommended to the definition(s) will, in the medium term, result in custom made devices requiring pre-approval by the TGA and included in the ARTG. This is appropriate and should be welcomed by the sector. The changes to the definitions will also bring some of the lower quality or lower scale activity within the value chain within a more meaningful and appropriate regulatory regime.

3DMEDiTech is aware that the low cost barriers to entry level 3D printers and materials have encouraged a number of individuals and/or companies within the “maker movement” to attempt the creation of prosthetics and orthotics, including some with embedded electronics. 3DMEDiTech and its clinical partners have been alarmed by some of the procedures, materials and lack of clinical oversight utilised by those deploying high profile marketing campaigns for these devices to highly vulnerable Australians.

Example - Re:Purpose for Good

One example of concern is Re:Purpose for Good.¹ This organisation is aiming to manufacture low cost robotic prostheses from single use plastics and e-waste and is currently working on a prosthetic leg for someone who lost theirs to a rare cancer; a finger for a woman working in the army; and a hand for a child who was born without one. To begin making their products more widely available to the Australian public, they recently raised \$10,000 on a crowd-funding website.

The company reports that the prosthetic is designed using 3D modelling for the mould, automation, programming and electronics. Waste plastic, like ABS and PET, is collected with examples indicated for ABS as being keyboards and Lego and for PET as water bottles and peanut butter jars. The materials are then shredded, washed and extruded into filament that is then used in the 3D printer.

Whilst no clinical input or oversight is mentioned, the company has already made a number of claims vigorously refuted by the Australian Orthotic Prosthetic Association (AOPA). These include that the currently available prostheses in Australia are impractical, expensive and can be painful. Further Re:Purpose for Good have also claimed that design in Australia is a ‘one size fits all’ approach and that ‘more invasive surgery is required to make the prosthetics fit the person, instead of customising for their specific needs’.

These claims, and the processes described, strongly suggest that this manufacturing is in breach of both the current and proposed regulatory regime. This is of deep concern given patient vulnerability, the need to promote their safety above all else and the profile that is being taken by the organisation. Further, it raises serious questions about the enforcement of the current regulations which is not something, given the TGA’s international reputation and the reliance that the Australia public has on them for their safety, that should continue. Enforcing regulations is as critical as writing them effectively.

¹ <https://chuffed.org/project/repurposeforgood> Accessed 28 November 2017

² Libby-Jane Charleston, ‘How a team of Aussie geniuses are creating robotic prostheses from recycled plastic’. Huffington Post. 18 November 2017. http://www.huffingtonpost.com.au/2017/10/27/how-a-team-of-aussie-geniuses-are-creating-robotic-prosthetics-from-recycled-plastic_a_23256278/. Accessed 3 December 2017

The definitions therefore need to be further tightened. The threshold for ‘rare patient conditions or anatomy’ (page 9) should actually be reflected in the definition of a custom made device and clarified. Without this clarification, 3DMEDiTech sees the potential that producers of devices will argue that every patient is unique and has slightly different anatomy.

As it is currently written, the meaning of this is not sufficiently clear and could be open to both intentional and unintentional abuse. **3DMEDiTech would recommend aligning the Australian definition with that of the US FDA** to avoid this risk, deliver maximum clarity to producers and promote alignment between markets.

The US definition of a custom device was changed in 2016 and now requires that each device:

- i. is created or modified in order to comply with the order of an individual physician or dentist (or other specially qualified person);
- ii. necessarily deviates from an otherwise applicable performance standard under section 514 or requirement under section 515 of the FD&C Act;
- iii. is not generally available in the US in finished form through labeling or advertising by the manufacturer, importer or distributor for commercial distribution;
- iv. is designed to treat a unique pathology or physiological condition that no other device is domestically available to treat;
- v. either (a) is intended to meet the special needs of such physician or dentist in the course of the professional practice of such physician or dentist or (b) is intended for use by an individual patient named in the order of a physician or dentist (or other specially qualified person as designated);
- vi. is assembled from components or manufactured and finished on a case-by-case basis to accommodate the unique needs of individuals, physician or dentist; and
- vii. may have common, standardized design characteristics, chemical and material compositions and manufacturing processes as commercially distributed devices.

Importantly, the provisions for a custom device also include that: the device is for the purpose of treating a “sufficiently rare condition, such that conducting clinical investigations on such device would be impractical”; the production of the device must be “limited to no more than five units per year of a particular device type”; and a manufacturer is required to submit an annual report to FDA on the custom devices it supplied.³

A pathway from customised device to ARTG

3DMEDiTech welcomes the intent to ensure that 3D printed customised devices are registered on the ARTG. Given this, developing an appropriate pathway from the customised device environment to that of the ARTG is also critical and should be a priority. 3DMEDiTech recognises the challenges inherent in this but, given the above and other examples, believe this should be done expeditiously with a clear pathway established within the next 12 months.

Risk-based approach

The consultation paper raises the issue of supplies and of application and approval processes.

3MEDiTech considers that the risk here is not one solely relating to numbers of devices supplied or the classification of those devices but to the broader manufacturing framework and that this should be reflected.

³ Regulatory Affairs Professional Society, ‘FDA amends definition of custom device’. 11 October 2016. <http://www.raps.org/Regulatory-Focus/News/2016/10/11/25984/FDA-Amends-Definition-of-Custom-Medical-Device/> Accessed 28 November 2017. Emphasis added.

At present, underpinning the suggested new definitions, the risk-based framework remains the same i.e., Class I to Class III with their variations. As a risk-based approach, this is fundamentally flawed for a number of reasons, including varying compliance and evolving practice of manufacture.

Devices that are and have always been manufactured by qualified personnel, such as orthotic prosthetists, dental orthotists or podiatrists who manufacture a device according to their industry's best practice, are correctly identified within the framework as low risk. Many of the devices produced by these individuals are state-of-the-art and use traditional methods, often creating a mixture of machine and hand crafted devices with materials in which their producers have been extensively trained.

This is extremely different from the mass manufacture undertaken by some other groups who do not have the same extensive training and who utilise different and non-traditional designs and techniques.

The risk factor here may not be low, a factor inherently acknowledged in the consultation paper, and highlighted by the example above.

Different regulations and definitions are required to capture this situation. Appropriate protection is needed to enable those professionals who manufacture their devices in line with traditional and best industry practice to continue to do so. This is in both the interests of those individuals and the patients they treat and, in addition, these individuals have not behaved in any way for which they should be penalised. Further, they should not face any additional regulatory burden in terms of paperwork or compliance than they do at present.

Additional regulatory requirements for those manufacturing at scale would seem appropriate given the greater risk associated with their activities.

Example – Essential Principle 8—Infection and microbial contamination

A worker infected by a virus such as Avian Influenza who works in a traditional customised device manufacturing environment will not spread the disease particularly widely, simply due to the number of devices being produced.

In contrast, a worker with the same virus in a manufacturing environment producing customised devices at scale has the capacity to cause harm to a significantly higher number of people and this is without reference to the actual device itself.

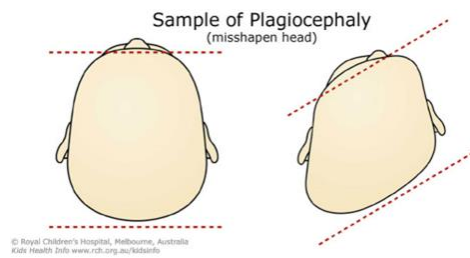
Whilst 3DMEDiTech considers that this risk is probably managed within the current regulatory environment and its Essential Principles, these are almost certainly not being enforced. The change in manufacturing technology and the evolution of large scale manufacturing of customised devices demands that the Essential Principles be rethought in a broader context.

Without addressing the duality of this issue, which is at the heart of the evolving 3D printing industry, groups will continue to make devices without appropriate clinical oversight and/or without appropriate mechanical knowledge and manufacturing properties.

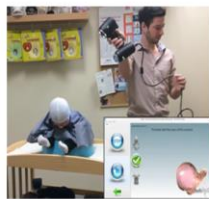
This would represent a failure of appropriate protection and oversight and a lack of quality control which ultimately risks patient wellbeing.

Example – Reinventing the plagiocephaly helmet

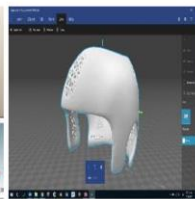
A good example of how the need for oversight and quality control requirements change with evolution in technology is plagiocephaly helmets. OrthoKids, one of 3DMEDiTech's clinical partners, is one of seven Australian orthotic prosthetists that have manufactured a plagiocephaly helmet in a traditional manner which they have perfected over many years and in which the individuals producing have been extensively trained. This should continue to be able to be manufactured in a light touch regulatory framework.



In contrast, the Serkel helmet should be fully assessed and added to the ARTG. If these helmets were, for example, produced in “small” “medium” and “large” or as “one size fits all”, it would be mandatory for them to be on ARTG. Their mass customisation should not therefore mean that they are exempt from this process. Instead, given that mass customisation creates a greater number of risk points in design and manufacture compared to traditional mass production, it is patently ridiculous that mass customisation should have less regulatory oversight.



Step 1. Scan patient.



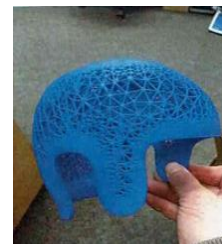
Step 2. CAD design.



Step 3. 3D Print.



Step 4. Final Helmet fitting.



Recommended approach

To address this issue, 3DMEDiTech would seek a resolution that supports the ongoing work of those professionals who are producing devices that are made in a traditional or ‘artisanal’ manner and enables them to continue to operate in a light touch environment. This could be achieved by grandfathering existing professionals either by qualification, craft group membership or by some other mechanism suggested by the TGA. This would not necessitate the craft group or qualifying body accrediting individual professionals as such but instead would simply acknowledge that these groups’ membership requirements reflect a level of training and experience that is acceptable for the manufacture of the type of devices being produced.

At the same time, regulations are required that will ensure that other manufacturers who are producing at scale, utilising non-traditional design and other technologies, are captured within a more rigorous regime and their products evaluated by the TGA and added to the ARTG.

This would require further clarification of the current categories and the introduction of regulations that recognise the manner by which devices are created, not simply the type of device being produced. This begins to be captured by the notion of a medical device production system but both additional expansion and further refinement of the proposed definitions are necessary.

Proposal 2: Changes to custom made conformity assessment procedure

Given that it is an open secret that the current conformity assessment procedure is not working adequately and that the manufacturing environment for devices is changing rapidly, we would support the suggested changes.

Ensuring that manufacturers need to provide statements about a custom device to a patient receiving it and that documentation be maintained for a period of time seems logical. Likewise, 3DMEDiTech supports the proposed changes to the TGA's entry and inspection rights in relation to custom made device manufacturing sites, given our concerns about compliance and the need to enhance its current status.

Whilst also supporting the concept that annual reports be provided to the TGA about the custom made devices a manufacturer has supplied, it should be specified what information the annual report should incorporate. At a minimum, we would recommend that these annual reports should incorporate:

- i. details of the type and number of devices produced;
- ii. information about the profiles of the patients receiving these devices (i.e., age range, disease states, geographic location, general demographics);
- iii. referring practitioner types; and
- iv. Expected device usage lifespan, including a minimum and maximum range.

Proposal 3: Changes to definition of manufacturer

Clarification regarding the definition of manufacturer is critical to ensure patient and public safety.

3DMEDiTech supports the change to the definition of manufacturer to include that, where an individual modifies a device already on the market or put into service in a way that affects compliance with the essential principles *or any other aspect of the regulatory regime*, they shall assume the obligations incumbent on manufacturers. This aligns with our desire to see a strong regulatory system in place together with appropriate protections for patients and the public.

3DMEDiTech is concerned about the suggestion that 'low risk medical devices' have special arrangements in order to enable them to be printed in certain locations, such as the examples used of dental offices or hospital laboratories, with different conformity assessment provisions. This links to our concerns regarding the basis for the risk-based approach as outlined in relation to Proposal 1 and some of the flaws inherent in this approach.

The changes regarding *medical device production systems* are not, for example, sufficiently nuanced. The issue here is not simply the risk classification of the medical device being produced but *how* it is being produced.

Where a self-contained system that has been approved by the TGA and included in the ARTG is being used as specified and with the materials specified, i.e., as a 'closed' system, 3DMEDiTech would support the suggestion that the manufacturer of the system should retain the responsibility as the manufacturer of the finished product.

However, this should not be the case where any changes to either the software, materials utilised or the printer itself are undertaken as this should mean that the production system at that point ceases to hold TGA approval or be registered on the ARTG. Whilst 3DMEDiTech assumes this to be intended, it is not stated and should be.

Fundamentally, no changes should be made by the user or the environment that alter the production system or the final medical device without a corresponding loss of registration and a change to who is then

designated the manufacturer of the end product. Where a closed, robust production system produces a medical device, the responsibilities of manufacture should be considered as those of the manufacturer of the system; where any change is made to that production system, its software or the materials it utilises, the manufacturer of the system should not be considered the manufacturer of the final device.

Recommendation

3DMEDiTech would like this situation to be clearly addressed in the regulations so as to protect patient and public safety. Appropriate safeguards should be introduced together with corresponding penalties so that potential changes are both discouraged and, if undertaken, strongly penalised.

Proposal 4: New classification for anatomical models and digital 3D print files

3dMEDiTech agrees that a medical device intended by the manufacturer to record diagnostic images should be classified as Class IIa. This aligns with the current rule for X-ray film and would hold manufacturers to an appropriately high standard.

There are significant complexities in the interpretation of various scan data sets used in the creation of anatomical models and digital 3D print files. 3DMEDiTech are anecdotally aware of ad hoc use of this technology in Australia and overseas which does not conform with the level of standards which is appropriate.

Proposal 5: New arrangements for devices with human material

3DMEDiTech generally agrees with the proposal to align the regulation of medical devices that have as a component, but are not wholly comprised of, human origin material with the European and Canadian classifications. This is, however, neither our focus nor expertise.

Conclusion

3DMEDiTech appreciates the opportunity to provide input to the TGA's consultation on the regulatory changes proposed to personalised and 3D printed medical devices. Whilst generally supportive of the direction being taken, there are areas in which the proposed changes could and should be clarified and further tightened. The company commends the TGA however on recognising the changing nature of the 3D printing industry and supporting regulatory change that will protect patient and public safety given the risks inherent in the evolving sector.

3DMEDiTech would welcome ongoing dialogue and interaction with the TGA regarding our recommendations.



3DMEDiTech™
Customised healthcare solutions

3/40-44 Cook Street,
Port Melbourne VIC 3207

3dmeditech.com