CHALLENGES IN ESTABLISHING MALAYSIA’S FIRST TISSUE ENGINEERING COMPANY

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1.0 Introduction to Tissue Engineering

By definition, tissue engineering refers to engineering functional human tissue outside a body host in a controlled environment such as a laboratory, with the intention of restoring functionality of donor host upon implantation (1). Tissue engineering is a widely expanding field in today’s medical world, everyday potentially enriching lives with outstanding new inventions. It provides a quicker path to “personalized medicine”, which medical professionals consider the main goal to achieve optimal healthcare services.

One of the most useful sections of tissue engineering is producing autologous human organs that are more biocompatible and decrease the possibility of rejection (2). Although new in Malaysia, the field of tissue engineering emerged long ago, targeting only a few types of human tissue including skin, bone, and cartilage. The field gained a foothold with the founding of the Tissue Engineering Society by Dr. Charles A. and Joseph P. Vacanti in Boston in 1994, and interest has been expanding since (6). In the United States, a few companies that have made their way to success include Organogenesis, Genzyme, and Stempeutics (6).

According to the current market analysis, the global tissue engineering and regenerative medicine market reached $17 billion in 2013, and is expected to reach $56.9 billion by 2019, with a compound annual growth rate (CAGR) of 22.3%. The North American market reached $7.3 billion in 2013 and is expected to grow to $22.8 billion by 2019, with a CAGR of 20.5%. The European market reached nearly $6.9 billion in 2013, and is expected to grow to $22.3 billion by 2019, with a CAGR of 21.9% (7).

Malaysian market however, is still in its infancy and very early stages of development. Research started to flourish after the first Biomaterial and Tissue Engineering Conference held in 2004. Prior to the conference, only a few stem cell banking companies had been established. Preliminary initiatives of tissue engineering research have been started by public
universities and institutes (8). Currently, a number of private institutes have introduced this academic section in the syllabus. Other than cell banking, Malaysian market remains untapped, especially in the category of engineered human tissue.

2.0 Challenges in Malaysia

2.1 cGMP facility - a critical requirement

When CTT was initially established, facility was one of the biggest challenges because it is critical to have a cGMP certified lab in order to manufacture living cells and tissues of human origin. In Malaysia, this type of facility is accredited by the National Pharmaceutical Control Bureau (NPCB). Operating in compliance with PIC/S and Therapeutic Goods Administration (TGA) guidelines for cells and tissue product requires the facility to maintain a controlled environment for production with dedicated grades, material, personnel, waste flow, periodic calibration and more (3,4,5). These requirements made it very complicated and costly to enter the industry, which results in further delay of the clinical trial initiation and company formation.

2.2 Limited funding and resources

Usually an investment of USD50-100million is required to launch a tissue engineering business in US or Europe. This was not the case in Malaysia when CTT started; as not many investors or venture capitalists were brave enough to take on anything like this. Huge funding is needed not only during initiation, but also to maintain the company's dormant stage known as the “valley of death”, where burn rate is high and revenue generation is almost zero. It is also difficult to convince investors to continue funding because there is still no proven record of success for any tissue engineering business in Malaysia (8).

2.3 Specialized manpower and highly skilled workers

Tissue engineering requires highly efficient and skillful personnel to handle valuable human cells. Production scientists had to be extensively trained so they could perform according to cGMP standards and manufacture successful, viable TEMPS. This created another barrier for CTT since training and retaining staff requires lots of time and high up-front costs.

2.4 Uncertainty in regulatory framework

Until now, the regulatory framework is still in drafting stage. This makes it extremely difficult for CTT to prove that the products meet specific regulatory approval and compliant to worldwide standards, like pharmaceuticals and medical device industry. It also creates opportunities for non-genuine manufacturers to enter the field with inadequate scientific evidence and studies, let alone ethics or production standards. Most of these “snake oil” companies exist due to low-entry barrier and the “opportunity” created by the absence of regulations. Without firm, established standards, anybody can claim themselves as tissue engineering companies and this could easily tarnish the good reputation of the stem cell and tissue engineering industry as a whole.

2.5 Clinical Trial

Long and costly clinical trials are also viewed as a huge setback for any newly established, medical-based company with goals to generate income within a reasonable time. Clinical trials can go on for years without promising results at completion. In order to become marketable and generating revenue however, CTT must ensure that at least a series of credible national-level clinical trials are successfully executed with decent results. Cost and time are the main challenges here, together with manpower and the overall execution.

2.6 High cost of production and maintenance

Running a production in cGMP standard means high cost for laboratory maintenance and manpower retention. This results in another challenge, which is to create a feasible business out of it. CTT must find a way to have reasonable selling prices that sustain the business through sufficient profit margin, but not so expensive that their prices dictate catering to a specific, thus limited, market segment. At the same time, CTT must carefully consider minimizing costs without compromising quality because its product directly affects human life and health. There is a thin line between making a profitable business and serving the community with affordable tissue engineering solutions, and the narrow margin can leave CTT in a challenging situation.

2.7 Striking balance between medical ethics and business profitability

It is also tricky to make business decisions to ensure profitability and sustainability while at the same time ensuring all processes are medically ethical and meet the highest standards with regards to public safety and efficacy. Sometimes, in order to safeguard the public from harmful new treatments, manufacturers invest heavily in trials, testing, refinement and unnecessary production protocols, that the result is the costs consume the profit. At the same time, if CTT focuses too much on profit, product quality would be compromised; safety and efficacy go out the window, and the lives and health of the public end up at risk.

2.8 No existing reference
Since tissue engineering is such a new field in Malaysia, there is no clear frame of reference or foundation for how to go about effectively doing business. We have no choice but to invent the wheel and explore things on our own, trying many different SOPs before any conclusions can be drawn. This results in slower progress compared to other business, which operate based on proven models and can be directly mentored by seniors in the field. Without proven models, the ecosystem and support systems for tissue engineering from logistics, medical couriers, insurance, regulations, certification, patient registry, to marketing, and many more are incomplete.

2.9 Market expectations and acceptance

On top of all, there is still uncertainty when it comes to market expectations and acceptance of physicians and other medical professionals. Some will refuse to operate outside established comfort zones and will not be willing to expand their choices of treatment to provide new solutions for their patients. Instead of focusing on being a manufacturer, CTT will need to fund education program resources to facilitate understanding, correct mindset and awareness for all potentially involved stakeholders, which is seen as another expensive and complicated task requiring a plan in place at startup level.

3.0 Discussion and Conclusion

CTT must set the primary force and become proactive in initiating the ecosystem rather than simply supplying the TEMPS. This is equivalent to trendsetting the whole ecosystem rather than just supplying a product. A creative, effective approach to awareness needs to be taken seriously so everyone from patients, to doctors, to regulators can understand and embrace the importance of tissue engineering in providing credible choices of treatments. More industry-academia collaboration should be cultivated to ensure synergy development, so specific-interest growth eventually supports overall growth. An accurate, functional ecosystem gradually needs to be put in place so treatment delivery can be more effective and impactful.

Investors need to be more open-minded and willing to take risks so tissue engineering can grow and take its rightful place in medicine. Regulatory bodies also play important role in supporting the industry and must take into consideration industrial interests while drafting regulations so that it does not end up regulating things that could result in the death of a fledgling industry. A balance between safeguarding patients’ safety and nurturing a new industry must also be established.

Insurance companies on the other hand, should take the lead by recognizing tissue engineering as a reputable treatment option. They should make the treatment readily claimable and present it as an option that would encourage people to request new policies and coverage. Introducing the field into undergraduate academic curriculum must also be done to help increase public awareness by younger generations who will eventually pave the way to the future. Government-funded, specialized training centres for cGMP may be a better option than company-based training since company resources could very well remain limited in light of narrow profit margins. If all of these supports are in place, CTT will definitely be able to sustain the business by providing the best TEMPS with the greatest quality.

There is no “one-man-game” to win this mission. Every party needs to be holistically united to play an effective role in placing tissue engineering at its rightful place in medicine. Despite the long, windy, and lonely road that CTT has paved, there is great potential at the end of the road, potential we always been passionate about. We are positive that most of the challenges can be overcome with help from various involving stakeholders. We believe that tissue engineering has the capability to become one of the ultimate treatment choices or even the gold standard of treatment, especially for medical conditions that require transplantation. While we have done all the necessaries to initiate the industry, it is now the responsibility of everyone in the society as a whole, to join together to bring this medical segment to its promising destiny.

References


