

Doctors in Training Grant

FINAL REPORT



Performing pilot surgery with Breast and Endocrine Surgeon (Dr Clement Wong) and Chair of Regenerative Medicine (Professor Dietmar Hutmacher)

Dr Matthew Cheng

Clinical Research Fellowship
Plastic and Reconstructive Surgery

Princess Alexandra Hospital
Brisbane, Queensland, Australia



Over the past twelve months I have undertaken a Clinical Research Fellowship in Breast Tissue Engineering. The MIGA Doctors in Training Grant has generously assisted me during this fellowship. I have commenced my PhD in Breast Tissue Engineering whilst also continuing clinical work in the Plastic and Reconstructive Unit at the Princess Alexandra Hospital and Royal Brisbane and Women's Hospital (RBWH) in Brisbane, Australia.

My research work

Many might not realise, but Brisbane is quickly becoming a research world leader in Tissue Engineering. This is primarily through the Centre for Regenerative Medicine at the Institute of Health and Biomedical Innovation (IHBI), Queensland University of Technology, under Professor Dietmar Hutmacher. Professor Hutmacher is a distinguished researcher in the field of Tissue Engineering and has applied his research in multiple medical fields including plastic and reconstructive surgery, orthopaedics, maxillofacial and oncology. I have had the opportunity to work with Professor Hutmacher as my research supervisor.

Breast Tissue Engineering is an exciting new field of soft tissue regeneration. In principle we are trying to stimulate the body to regenerate breast tissue by using breast scaffold implants. The purpose is to regenerate breasts for women who have lost breast tissue following breast cancer surgery. We believe regenerating breast tissue will provide women with the most anatomical and natural breast reconstruction. Currently techniques for breast reconstruction are limited because they replace tissue rather than stimulating the body to regenerate it.

Our approach specifically involves implanting 3-dimensional printed breast scaffolds following breast cancer surgery. We fill the scaffold with fat harvested from the patient in a liposuction procedure. The injected fat then grows along the breast scaffold to regenerate a breast shape.

The scaffold then degrades leaving the regenerated tissue behind. We believe this procedure will be less invasive and more cost-effective, meaning that more women will have access to this method of breast reconstruction.

I am fortunate to be working within a large multidisciplinary research team at IHBI under Professor Hutmacher who has already completed a significant amount of work into researching this innovative method for breast reconstruction. My work was to investigate the efficacy and safety of using this technique in large animals. Our goal is to use the results to set up human clinical trials in order to translate our research into clinical practice.

I have commenced a large scale animal study utilising this technique for breast reconstruction. We split the animal study into two phases: a pilot phase, and the main study phase. A pilot phase has now been completed where we were able to successfully implant the 3-D breast scaffold and fill it with fat harvested from the animals. We have had a good outcome from these initial procedures. We recently received approval to proceed to our main study, which will be the focus for the remainder of the year.

The results from the pilot phase demonstrated a favourable feasibility to our novel breast reconstruction technique. The procedure was safe, quick, and less invasive and the animals demonstrated good recovery.

During the main study phase we will focus on the efficacy of the tissue regenerating by examining the amount of fat tissue regenerated within the scaffold. Our initial results are very promising.

I have also had the opportunity to develop my research skills within a well-established research group. In particular I have learnt novel immunohistochemistry techniques from my research group. I have also relearnt basic histology techniques, which I have not practiced since my undergraduate studies many years ago. This has given me a greater appreciation of the work and skill required to analyse tissue, which I often take for granted when in surgery. I believe this research opportunity has provided me with a unique insight which is valuable to my surgical training.

My clinical work

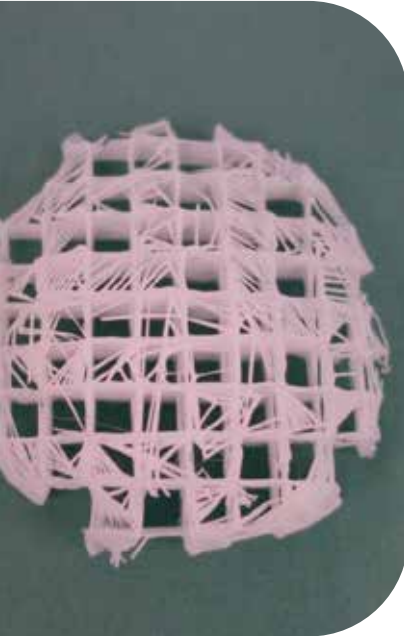
I have had the opportunity to continue clinical work through my Clinical Research Fellowship. This has been through the plastic and reconstructive units at Princess Alexandra Hospital under Dr David Theile Jnr and at the RBWH under Dr Matthew Peters. Continuing clinical work has been extremely valuable to me as a doctor in training. It has allowed me to continue developing my surgical skills concurrently with research. I believe the two work synergistically, as my clinical training has assisted me whilst conducting surgeries for my animal study, and my research has allowed me to stay up to date and better educate patients.

Recently, I have had the opportunity to work closely with Dr Matthew Peters who is a plastic and reconstructive surgeon, and director of the plastic surgery unit at RBWH. Dr Peters does a significant amount of breast surgery, including reconstruction. The ability to remain clinical has given me the opportunity to learn from him. I have been able to appreciate the advancements but also limitations that current techniques for breast reconstruction have. This has given me valuable insight into my research.

I have also worked closely with Dr Michael Wagels, who is also a plastic and reconstructive surgeon and my PhD clinical supervisor. As a clinician and completing a PhD himself, Dr Wagels has provided extremely important advice on my PhD project ensuring that my translational aims are always considered.

Final thoughts

The MIGA Doctors in Training Grant has assisted to fund my research. Unfortunately funding animal studies is quite costly and applying for funding is extremely competitive, therefore, I am extremely grateful for this Grant. Breast Tissue Engineering has immense promise for women with breast cancer in the future. We have the opportunity to produce superior breast reconstructions by regenerating breasts from the patient's own tissue. A significant amount of research and funding is still required, but I hope my research and future work will help move this into clinical reality.



Example of 3-dimensional printed porous breast scaffold

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