

The Minutes of the Derby Medical Society 16th November 2016
Derby Medical School Lecture Theatre

Virtual Surgical Planning in Maxillofacial Reconstruction

Apologies:

Dr Sally Archer

Guest Speaker:

Mr David Laugharne

Consultant Maxillofacial Surgeon, Royal Derby Derby Hospital

Head and neck surgery has challenges of a three dimensional reconstruction, the need to restore speech, swallowing, mastication and restore appearance. Surgery is difficult, inconsistent and there is a constant learning curve.

Previously the team could only use 2D imaging with X-ray and CT prior to surgical resection and reconstruction. There is now computer assisted modelling and design and this can also aid surgery.

History of head and neck surgery

Head and neck surgical reconstruction started with using local flaps. Archie McIndoe in East Grinstead used flaps to treat WW2 fighter pilots. McIndoe also started to develop psychological recovery therapy on his unit, encouraging soldiers who had experienced life changing injuries to integrate back into the local and wider community.

Pedicled flaps were developed in 1970, first was the pectoralis major flap. This is now used as a "get out of jail" flap or to cover large areas of defect.

The free forearm flap (Yang) was developed in 1981. This provides a wider variety of tissue, along with different volumes of tissues, which can be tailored to the defect. This results in improved vascularity and wound healing.

Fibula, jejunum, radial forearm, scapula and rectus sheath flaps are also widely used in reconstruction surgery.

Composite flaps are more complex when bone, soft tissue and muscle are resected. The success of flaps can be variable, particularly when trying to achieve jaw alignment.

How can this be improved?

A 3D model for use in reconstruction was first made for Mr Laugharne in 2008. The first models were basic and made of gypsum. The models are now acrylic based.

Surgical modelling has a number of benefits.

Process of making a 3D model:

High resolution CT imaging is obtained of the area of pathology and surrounding tissues involved in the resection. These images are then sent electronically to a company in Belgium who make a 3D computer model.

Surgery can be planned on the computer generated images and resection lines planned.

The potential fibula flap area is also imaged and the resection can then be planned.

The surgeon has the senior role in deciding resection lines and reconstruction on the computer generated images.

The company then make the cutting jigs so that surgical resection lines are accurate.

A model of the bones is then made and titanium plates made to measure.

Mr Laugharne then demonstrated the effectiveness of modelling and pre-operative planning by reviewing a number of post-operative photos showing reconstruction and alignment of recent mandibular reconstructions.

Maxillary reconstructions can be even more complex.
The same techniques are employed using a fibula flap although the surgical complexity is higher.

Other applications for modelling have been applied to the following procedures:

Skull deformities
TMJ arthroplasty
Trauma
Skull base surgery

Advantages of 3D modelling

Improved and more reliable reconstructive outcomes
Reduced human error
Reduced intra-operative time (reduces theatre time by 3 hours) and reduced ischaemic time of a flap
Improvement bone alignment for unktion and dental rehabilitation.

Disadvantages of 3D modelling see photo

Reduced ability to change surgery
Delay before surgery (turnaround time to receive model and plates is 2 weeks)
Added cost of £3200 per procedure BUT theatre costs are £36 per minute.
Cancer can progress so cutting jigs could be obsolete.
Disadvantages are further offset by reduced complication rates and improved quality of life for the patient.

The future of 3D Modelling:

Virtual surgery
Robotic surgery

In conclusion Mr Laugharne summarised that this was an evolving technology with the potential to predictably and consistently advance reconstructive outcomes. The specific, quantifiable outcomes need further research particularly with regards to cost - benefit analysis. The future may include in-house printing of 3D models

There were many questions on the topics of:

Viability of fibula flaps
Using 3D modelling to use as a matrix to grow bone
Feasibility of buying a 3D printer at Derby as it could be used by other specialities.

Register: 18 members
 3 guests

Next Meeting: Wednesday 30th November 2016

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Mr K Jones, President