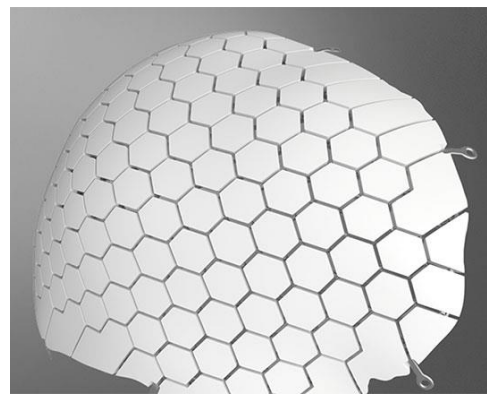
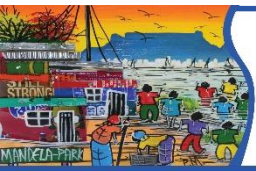
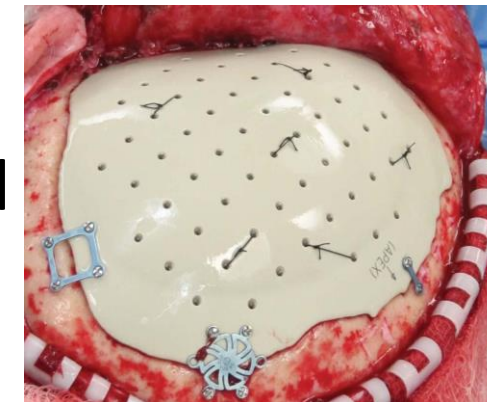


Autologous Vs Synthetic Cranioplasty; Should there be a change in practice?



Arif Zafar, Samantha Strickland, Shailendra Achawal
Hull Royal Infirmary, UK



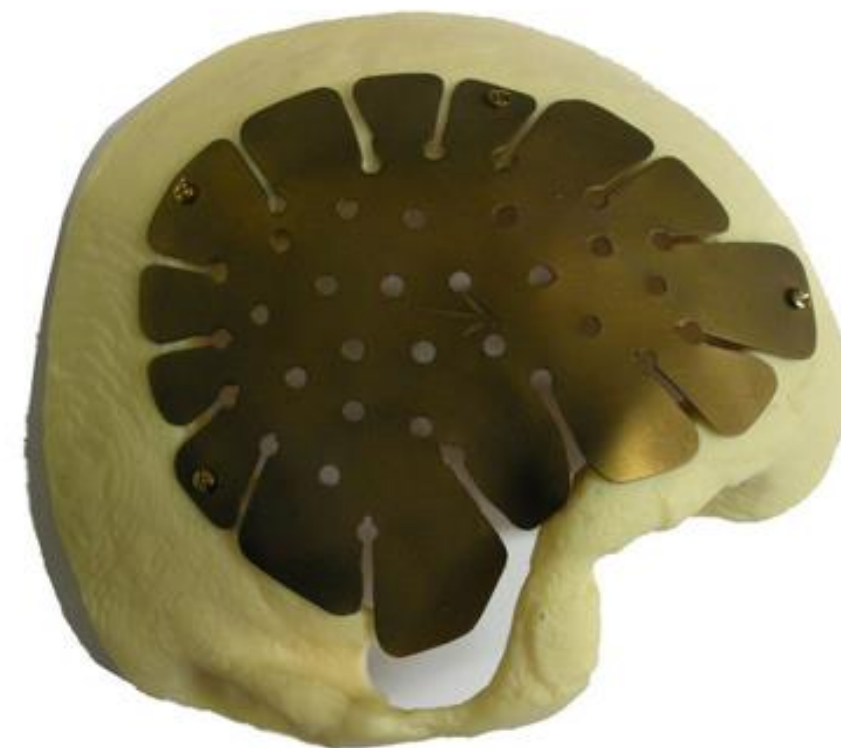
Background

- Practiced since 16th century
- Walther 1821 – First cranioplasty
- Macewan 1885: Routine replacement of trephined bone
- Wagner 1889: osteoplastic bone flap
- Sedel 1889: First delayed cranioplasty (Tibia)
- Muller & Konig 1890: Split calvarial graft
- Autografts: incl. ribs, scapula, ilium and sternum



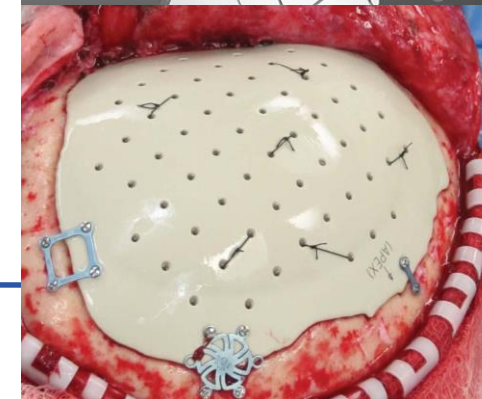
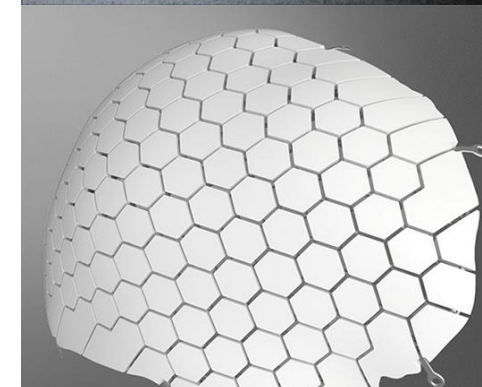
Materials - Metals

- Aluminium: Locally irritant and epileptogenic
- Silver / Gold / Platinum: Not cost efficient
- Lead: Toxic
- Alloys - Vitallium (cobalt, chromium and molybdenum) and Ticonium (cobalt, chromium, nickel, molybdenum)
- Tantalum: Commonly used to treat combat injuries in the second world war
- Titanium (Simpson 1965)



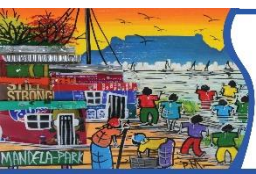
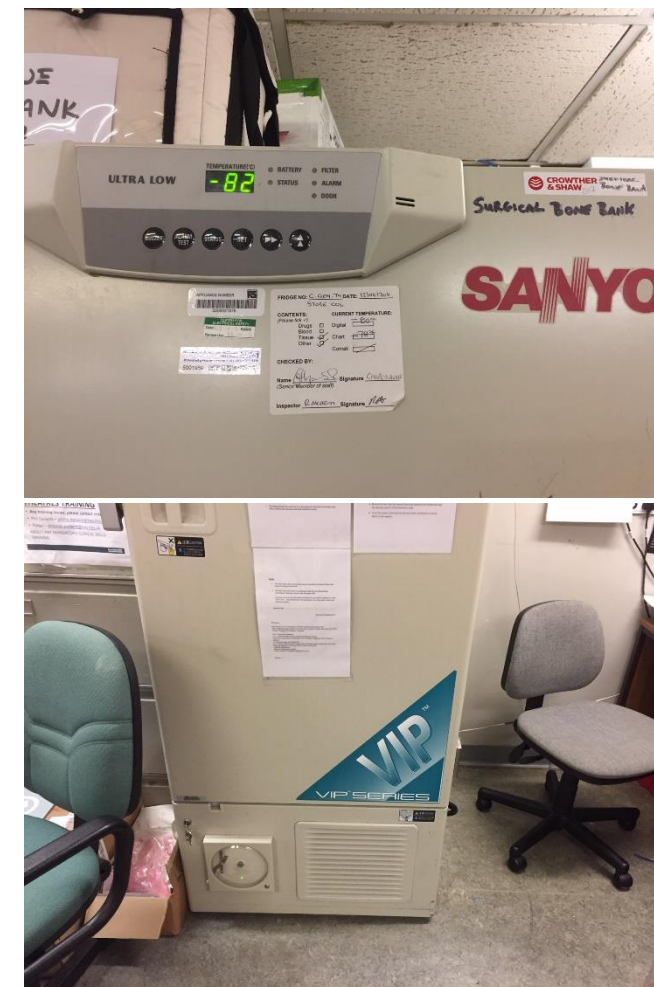
Materials – Non-metals

- Poly-Methyl methacrylate (PMMA) (aka Acrylic, Lucite, Vitacrylic, Plexiglass, Crystallite, Craniolast and Perspex) (Approx 1940)
- Bio-Active Ceramics – Hydroxyapatite (1998)
- Polyether ether ketone (PEEK) (1998)



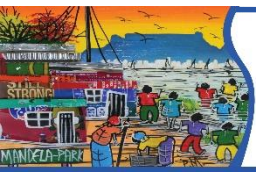
Methods

- Retrospective study
- June 2009 and March 2018.
- Data: electronic theatre records & bone bank register
- Bone flaps
 - Swabs and bone chips for MCS; discarded if positive
 - Placed in double sterile sealed plastic container
 - Deep freezer at -81 degrees
 - Prior to re-implantation
 - Thawed at room temperature
 - Either gentamicin / sterile saline / aqueous betadine



Methods 2

- Synthetic cranioplasty was based on surgeon preference/case selection - Titanium, Ceramic, Acrylic
- All fixed with 5mm self tapping titanium screws +/- mini plates
- Primary outcome – revision
- Also assessed complication rates



Costing



Acrylic
£4,130



Titanium
£500

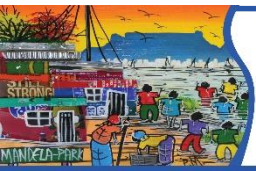
Costing 2



Custom-Bone Ceramic
£6000

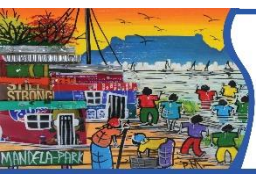


Hydroxyapatite
£4,960



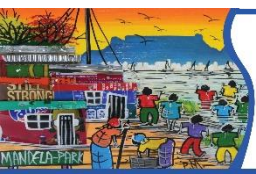
Results

- 144 patients undergoing a total of 146 procedures
- 2 Cases excluded
- 81 males: 63 females
- Mean age 51.6 years (Range 18.1 – 85.3 years).
- 51 Autologous: 93 synthetic
- Average interval 268 days (Range 16 – 1264 days)



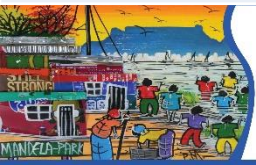
Traumatic Causes

	No. of Patients	%
ASDH	34	23.6
TBI	8	5.6
Extradural	7	4.9
Large Contusion	6	4.2
Depressed skull Fracture	1	0.7



Non-Traumatic Causes

	No. of Patients	%
Post op infection	28	19.4
ICH	22	15.3
MCA infarct	14	9.7
Intra-osseous tumour	10	6.9
Post op haematoma	3	2.1
Post op subdural empyema	3	2.1
Post op swelling	2	1.4
SAH Haematoma	2	1.4
Spontaneous subdural empyema	2	1.4
Post SAH infarct	1	0.7
SAH	1	0.7



Complications

	Overall	%	Autologous	%	Synthetic	%	P-Value
Infections	14	9.72	6	11.76	8	8.60	0.5654
Hydrocephalus	4	2.78	3	5.88	1	1.08	0.1273
Pseudomeningocele	4	2.78	3	5.88	1	1.08	0.1273
Haematoma	3	2.08	3	5.88	0	0.00	0.0427
Wound breakdown	2	1.39	0	0.00	2	2.15	0.5393
DVT	1	0.69	1	1.96	0	0.00	0.3542
CSF Leak	1	0.69	0	0.00	1	1.08	1
Chronic pain	1	0.69	0	0.00	1	1.08	1
Superficial Wound infection	1	0.69	0	0.00	1	1.08	1
	31	21.53	30	58.82	15	16.13	0.031

Bone Resorption

- Resorption 14 cases (27.5%) – 1.4% - 44% in Literature

6 significant resorption requiring revision
 8 partial resorption; conservative management

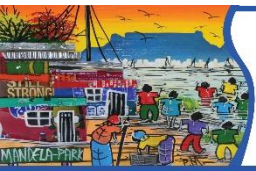
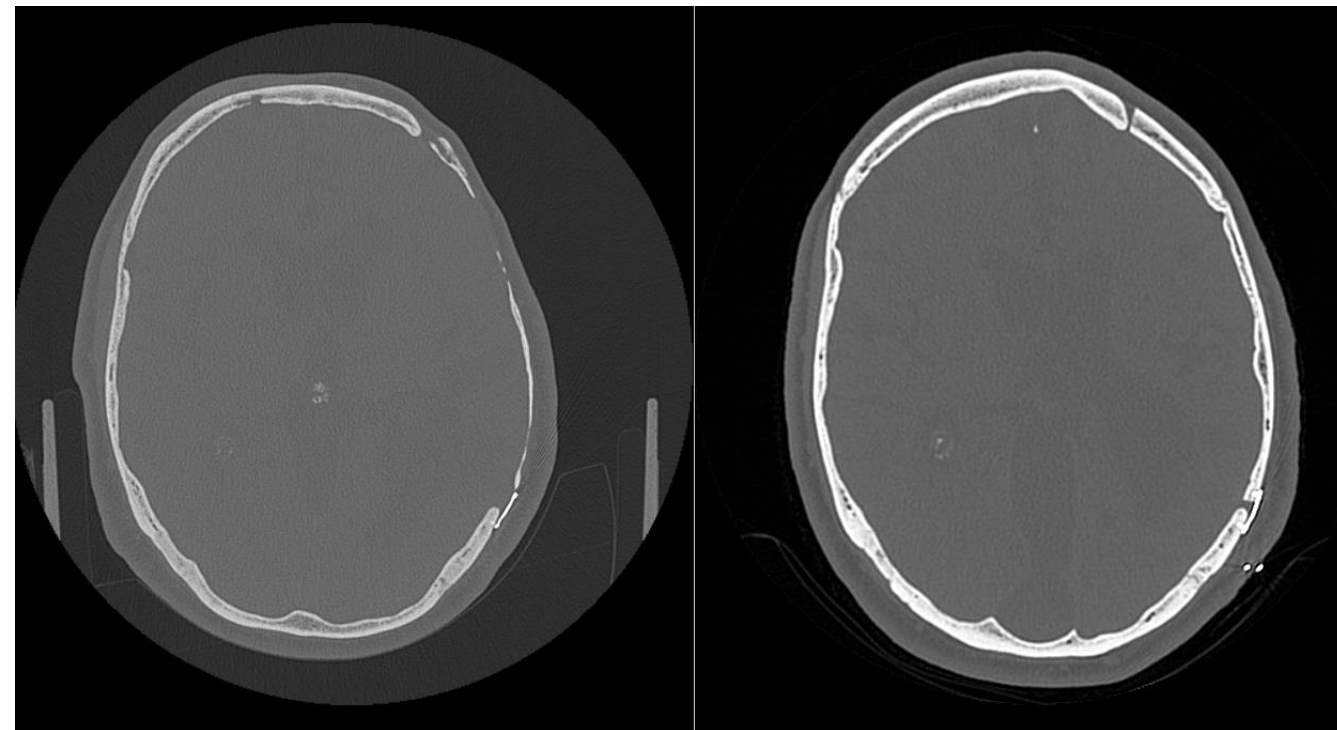
Average interval overall – 193 days (28 – 404 Days)

Average interval for revised cases – 228 Days (122 – 375 Days)

With resorption included in complication rate

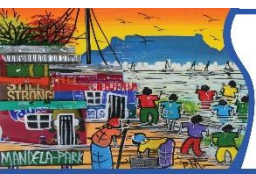
31.4% if only revised flaps included

54.9% if all resorbed flaps included



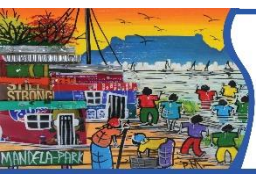
Revision Rate

- Revision rate 13.2% overall
 - 12 autologous group (23.5%) – 25% - 40% *in Literature*
 - 7 synthetic group (7.5%) – 0%- 14% *in Literature*
- **p 0.01**
- Relative Risk of revision in autologous group: 3.5 (Range 1.5 – 8.1)



Conclusion

- Revision rate and overall complication rate higher autologous group (P<0.05)
- There was no statistically significant difference in infection
- Results mirror recent publications
- Synthetic cranioplasty should be strongly considered



Thank you

Questions?

