Overview of the biomaterials usually use in alloplastic cranioplasty

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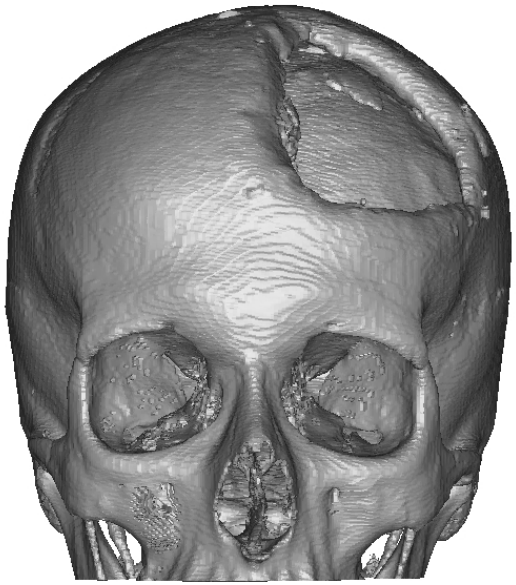
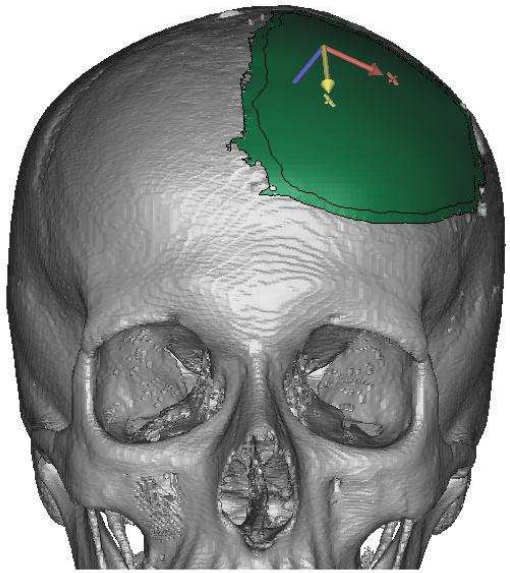
Definition

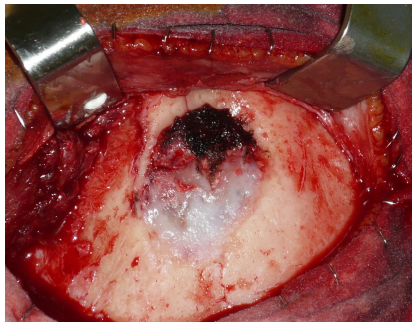
We denote by the term of **cranioplasty** all surgical techniques used to repair skull defects.



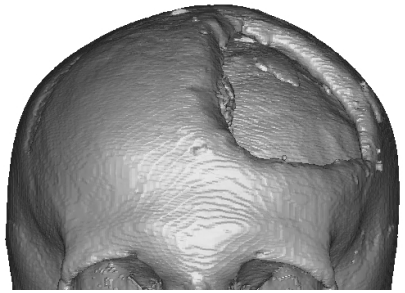


Types of bone defects

Small defect:
< 25 cm^2



Large defect :
entre 25 et 100 cm^2

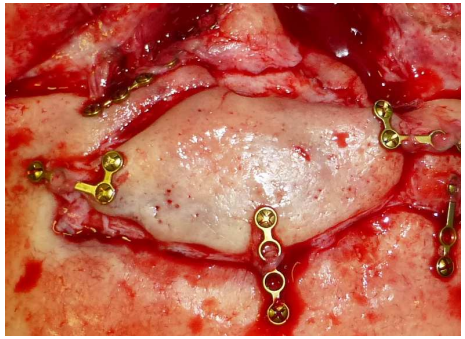


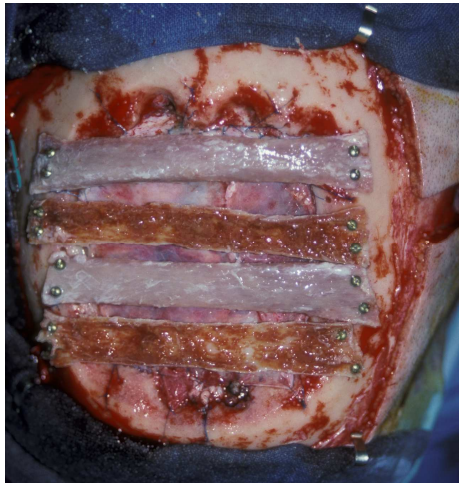
Very large defect:
> 100 cm^2

History of cranioplasty

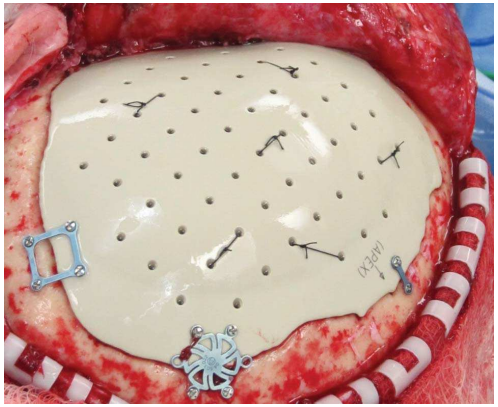
- 3000 ans Av JC (Inca civilization) : golden plate.
- **WALTHER (1821) : first bone autogreffe.**
- **ZANDER (1940) : acrylic cement (PMMA).**
- **SIMPSON (1961) : titanium plate.**
- **TOTH (1988) : first custom-made implant.**

Families of biomaterials



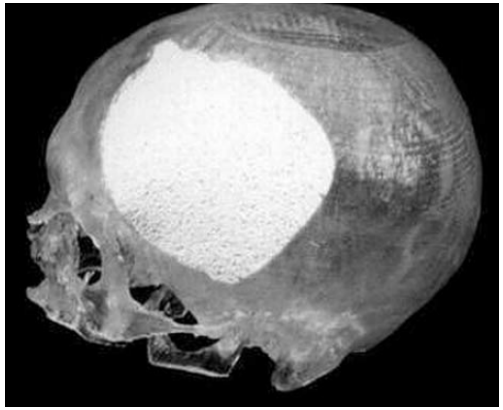


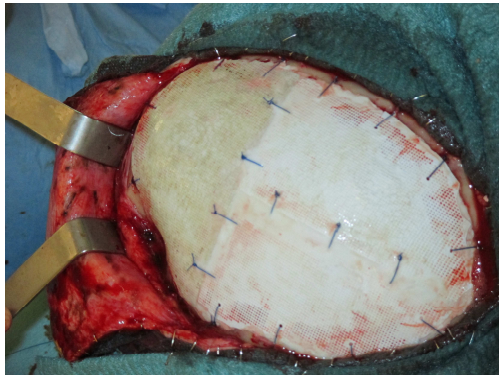
Bone autografts



Polymers

Titanium alloys





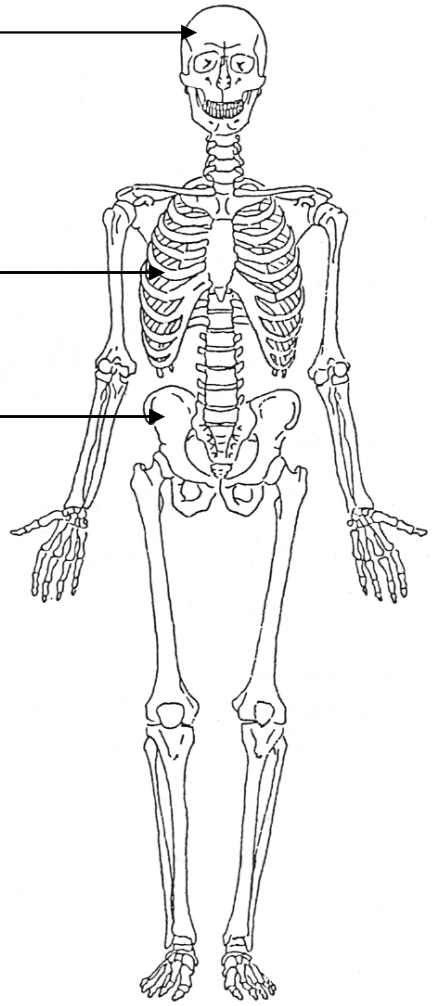
Phosphocalcic céramics

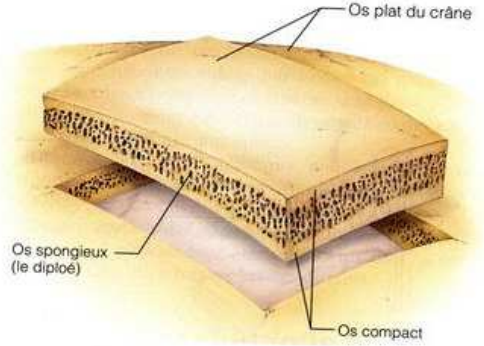
Bone autografts

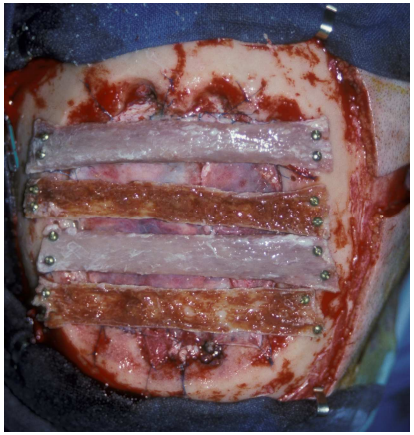
Skull

Ribs

Pelvis



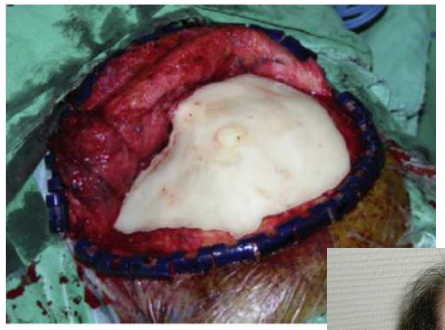




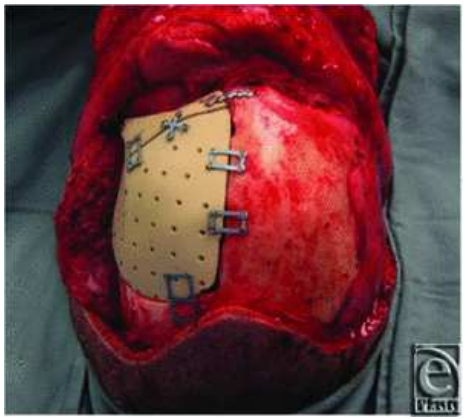
Limits of bone autografts

- They have a high level of resorption (up to 50%).
- Their ostéointégration is unpredictable .
- They are difficult to harvest and to model.
- They are responsible for an important morbidity rate of the donor site.
- They are responsible of the extension of the operating time and of the hospitalization duration.
- **Specially for the skull the available quantities are too low.**

Polymers



PMMA



PEEK

- Not easy to model.
- Hight rate of infection (up to 22%).
- Bad esthetic results.
- **No osteointegration.**
- Risk of cutaneous erosion with exposure of the plates.

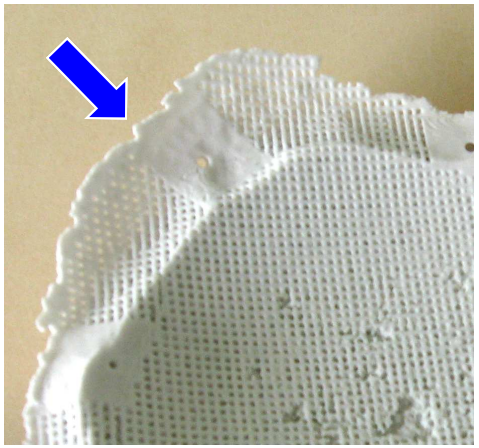
Titanium alloys

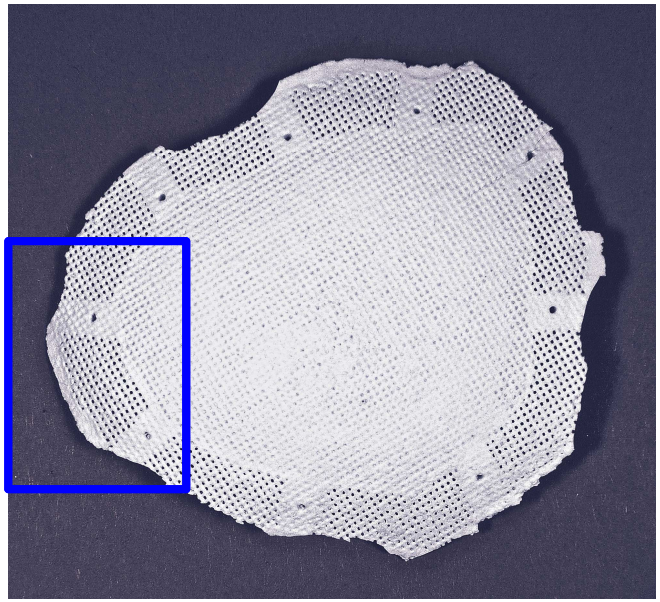
- Not easy to model.
- Bad mechanical properties.
- Risk of cutaneous erosion with exposure of the plate.
- **Thermoconductivity.**
- **Release of titanium ions toxic for the surrending tissues.**

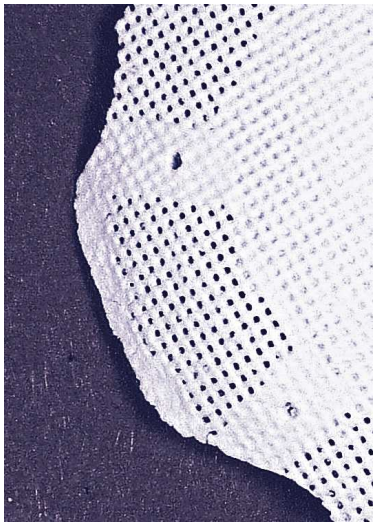
CUSTOMBONE^{R}

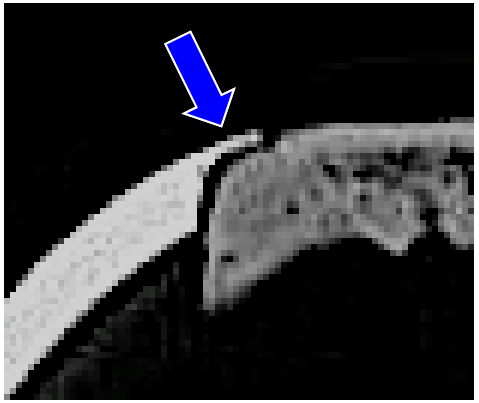
- Totally macroporous.
- **Bad impact strength.**
- Imperfect adaptation.
- **Imperfect ostéointegration.**
- Their use is difficult for defect over 100 cm^2.

FCP BIO CRANIUM^{R}

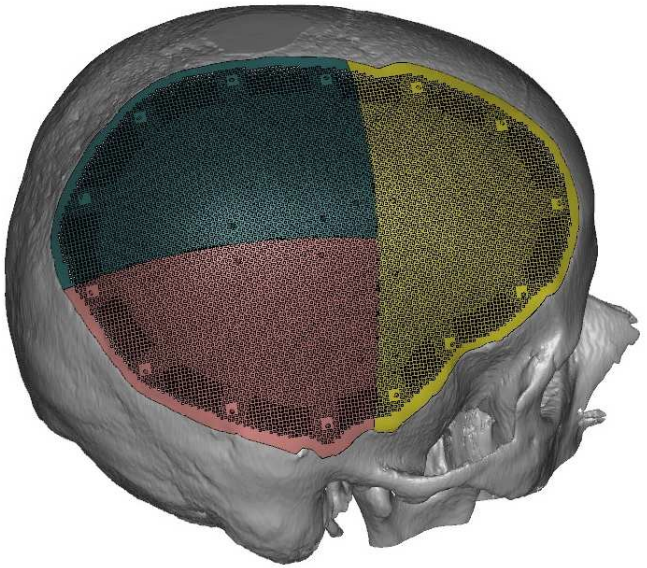


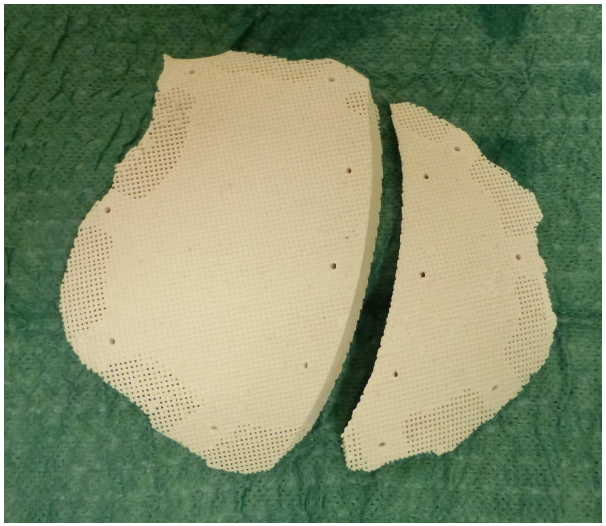


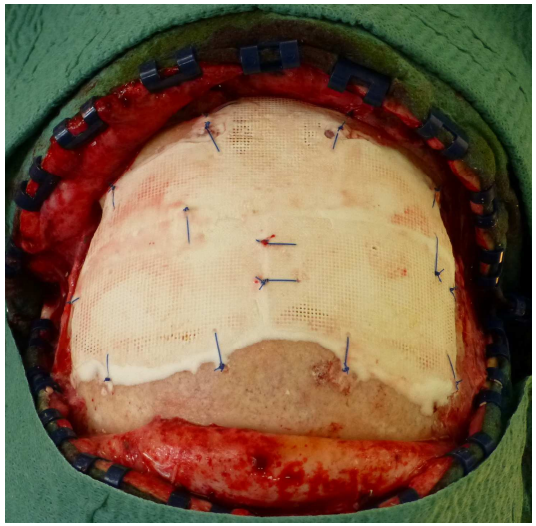


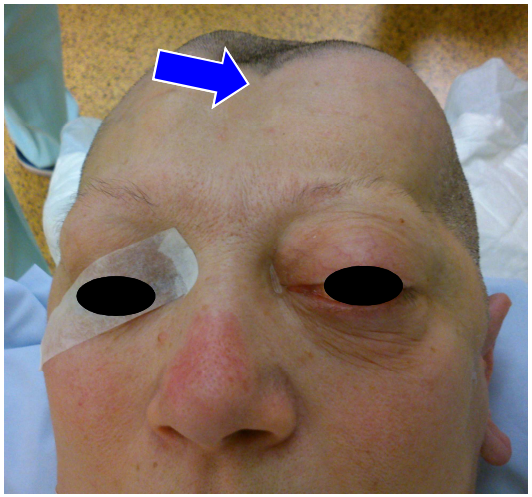


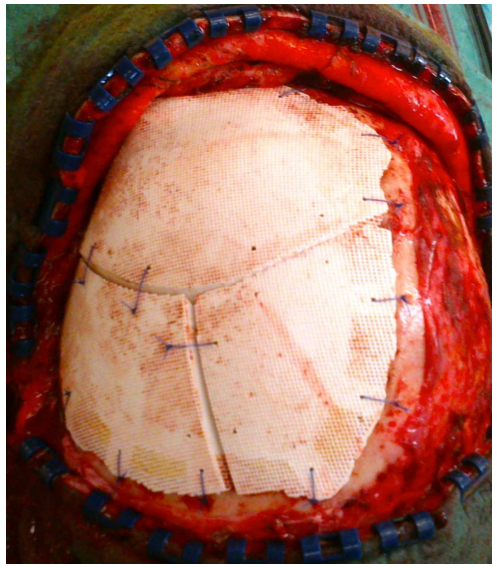
MULTI-PARTS implants

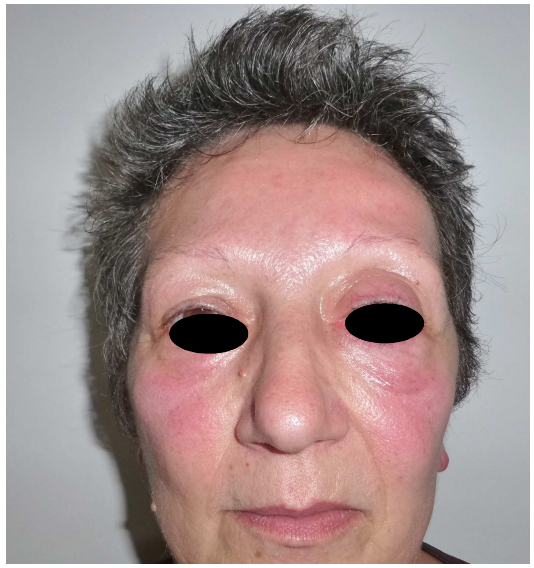


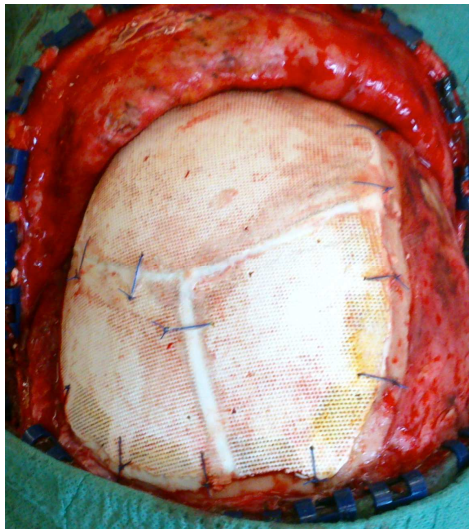


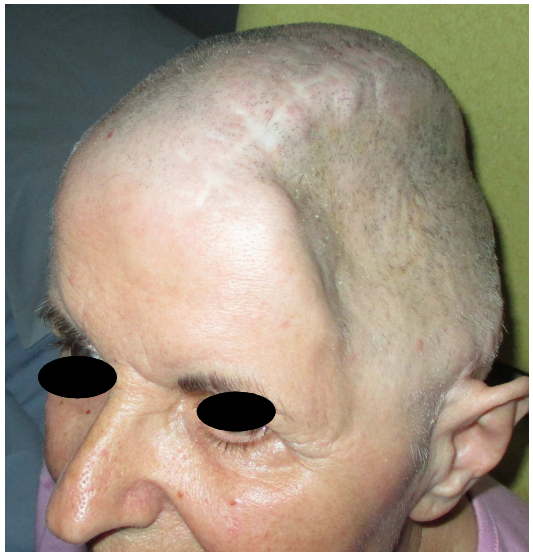


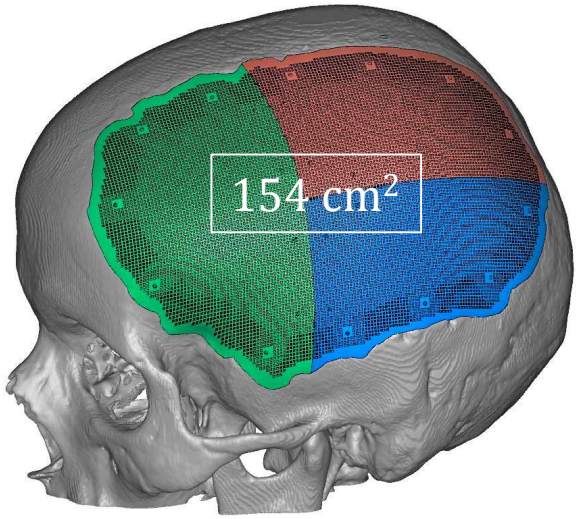


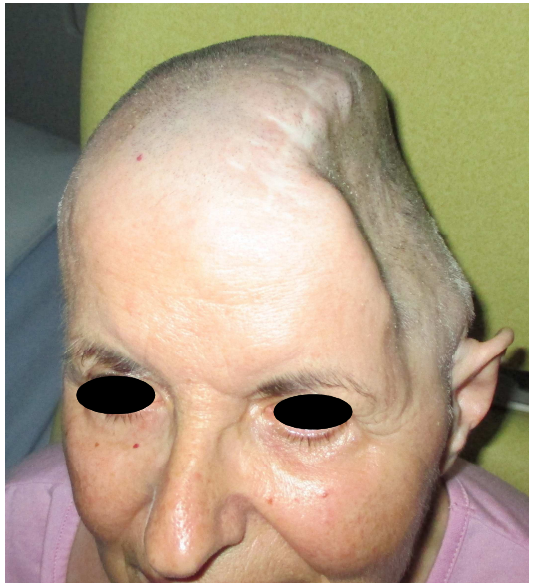


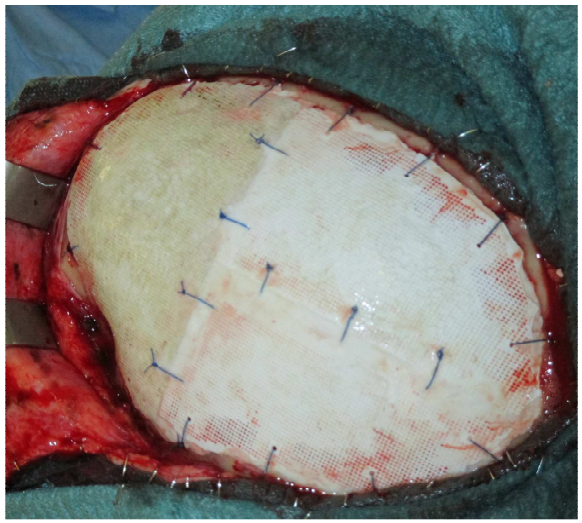


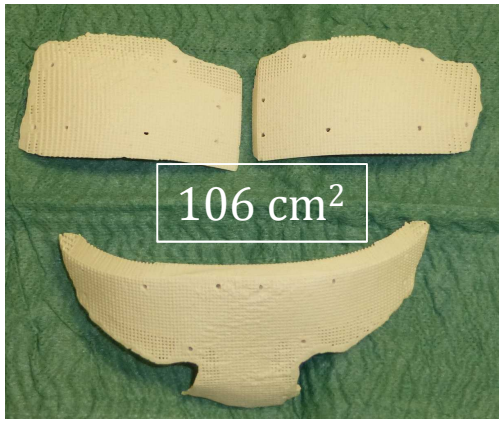


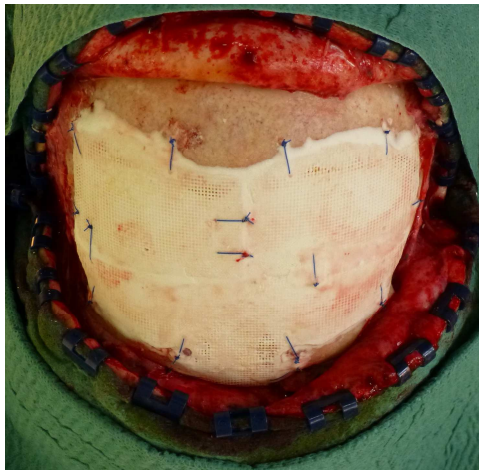



154 cm²

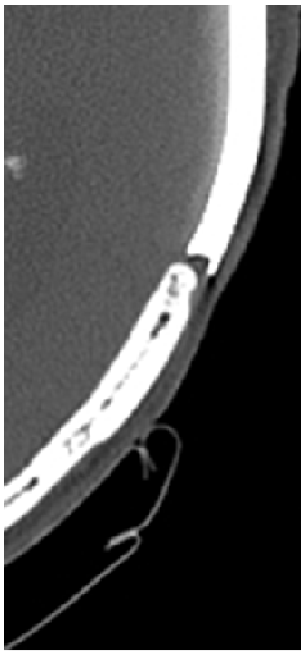




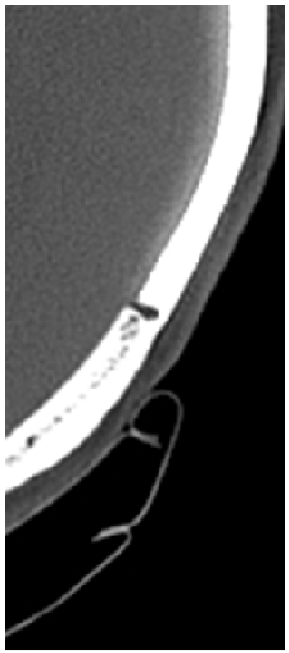

106 cm²



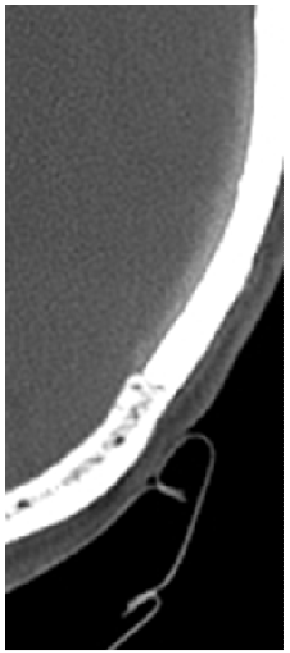
Osteointegration



No fusion



Partial fusion



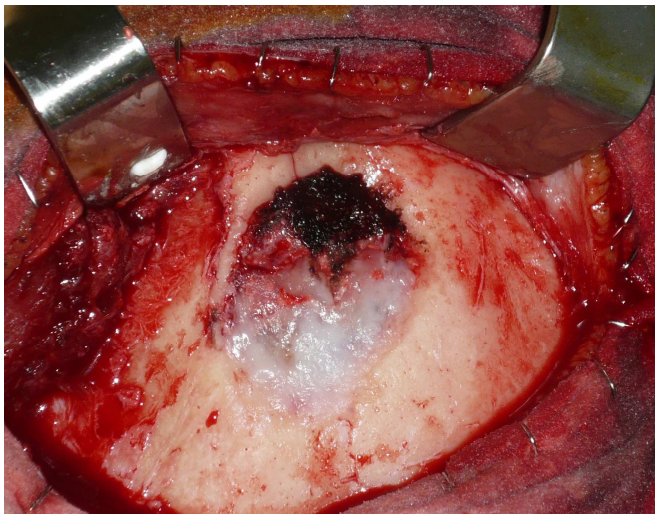
Complete fusion

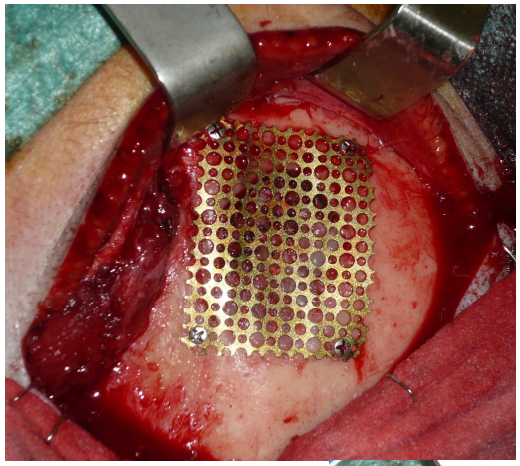
Osteointegration

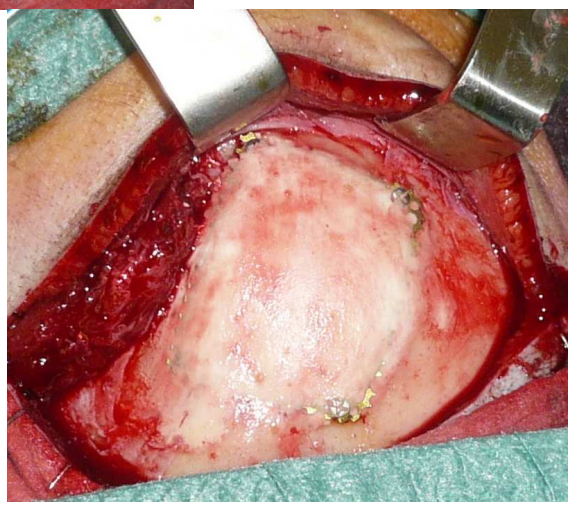
Setting-up deadline	Implants number	Contacts number	Complete Fusion
6 month	18	4368	39 %
12 month	14	2772	57 %
24 month	13	3276	**72 %**

surgical protocol

Small defect: < 25 cm^2

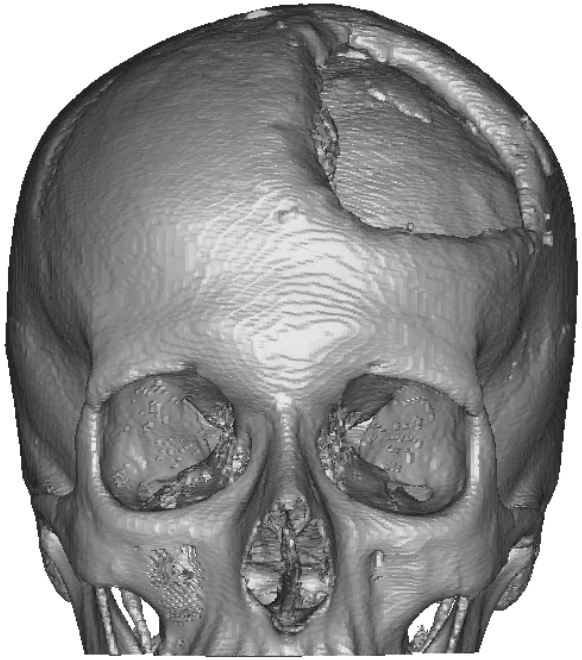


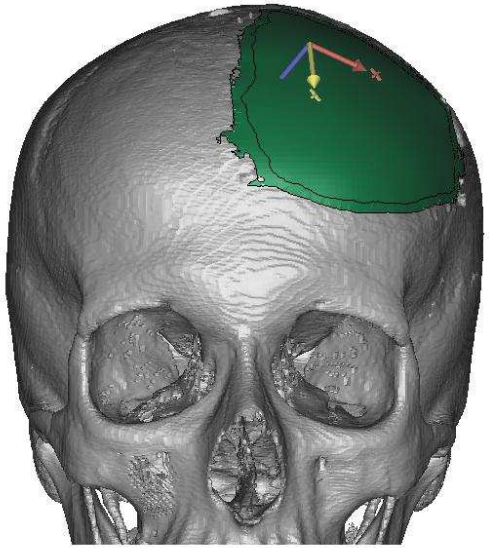


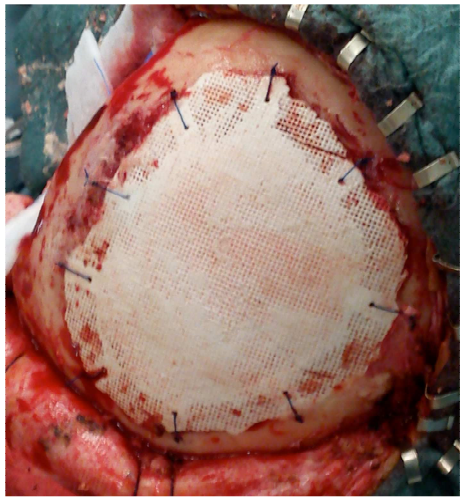


surgical protocol

Large defect : entre 25 et 100 cm^2

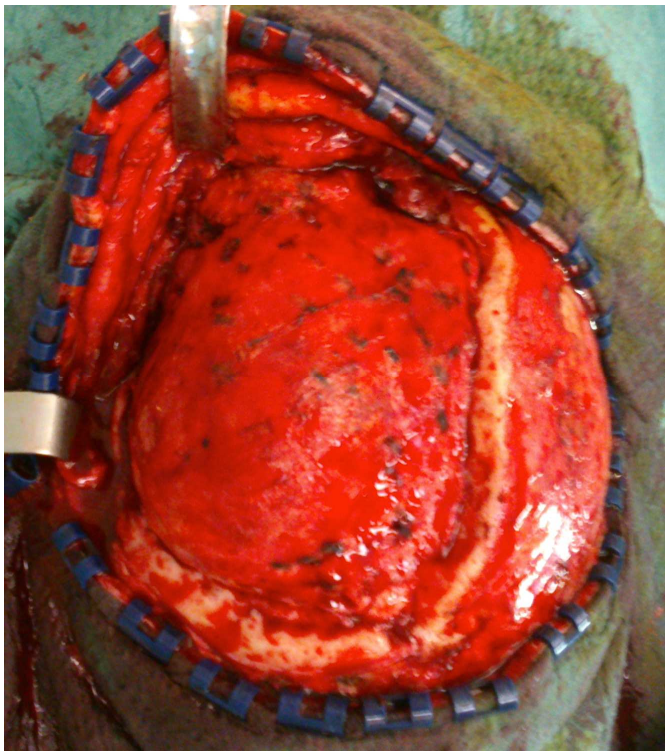


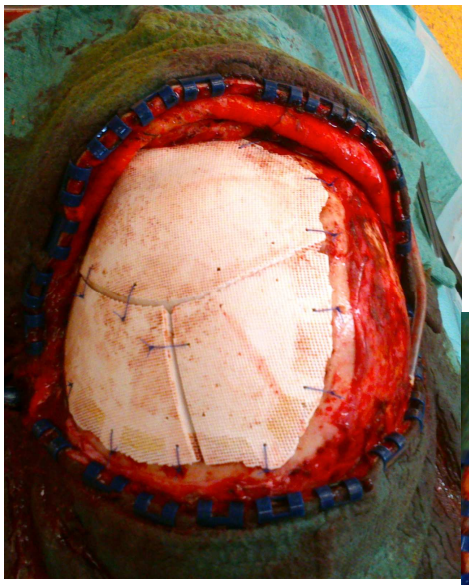


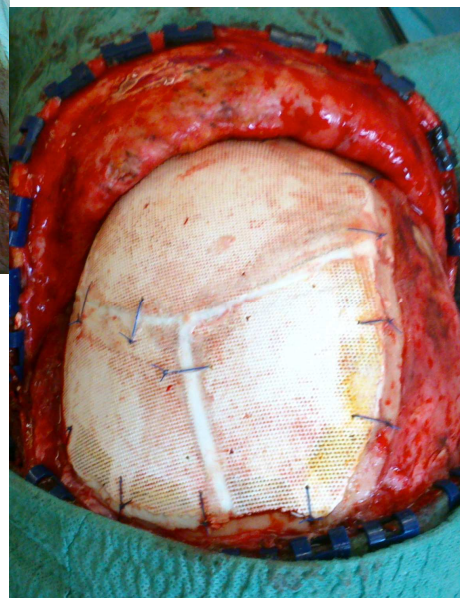


surgical protocol

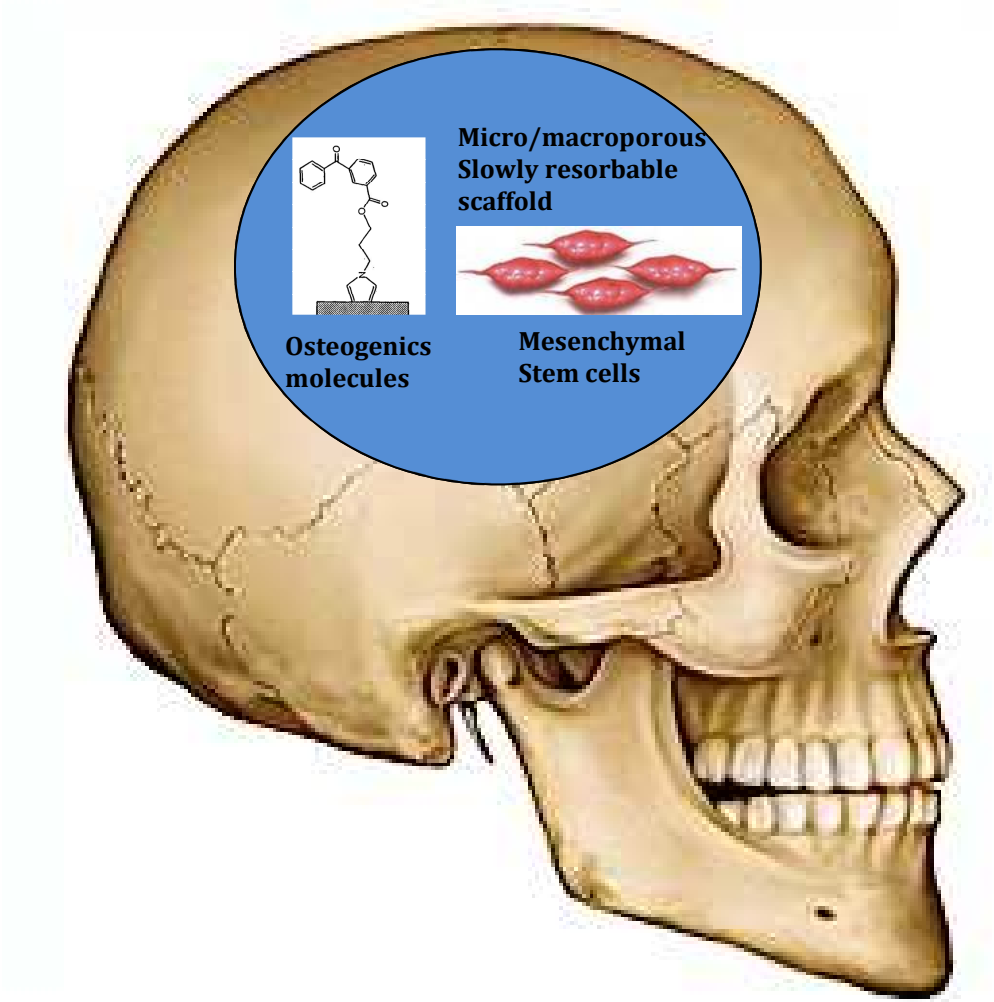
Very large defect: > 100 cm^2



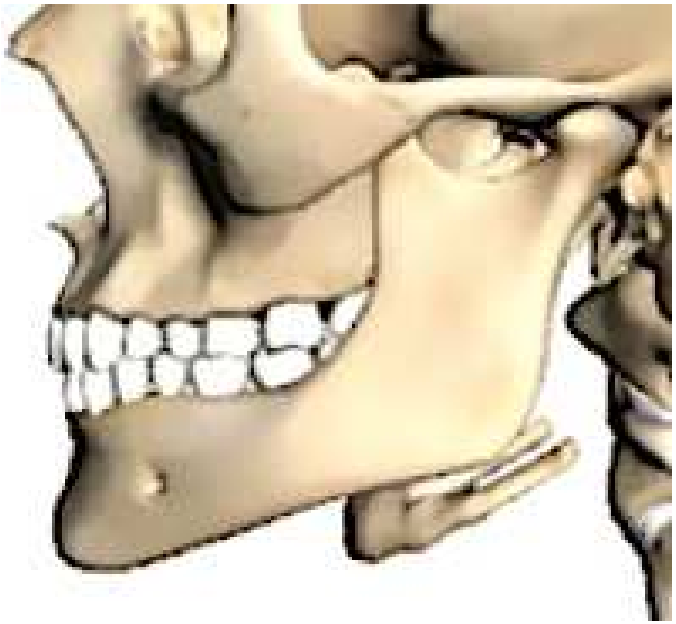


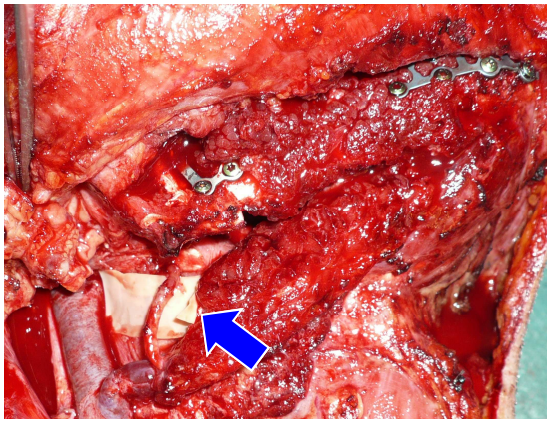


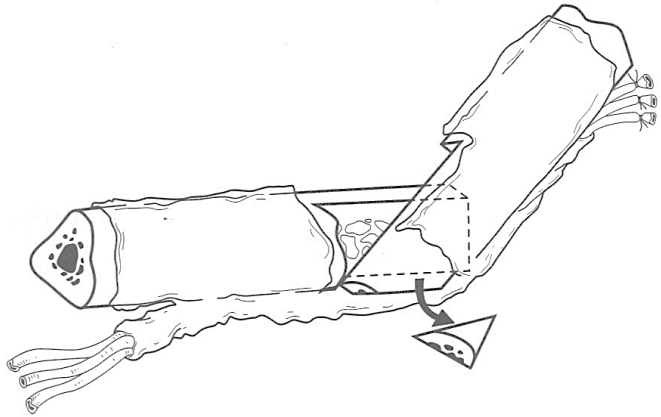
Future

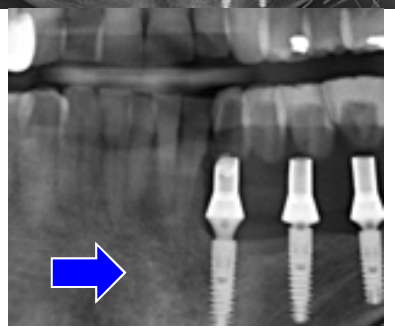

Micro/macroporous
Slowly resorbable
scaffold
Osteogenics
molecules
Mesenchymal
Stem cells

Future

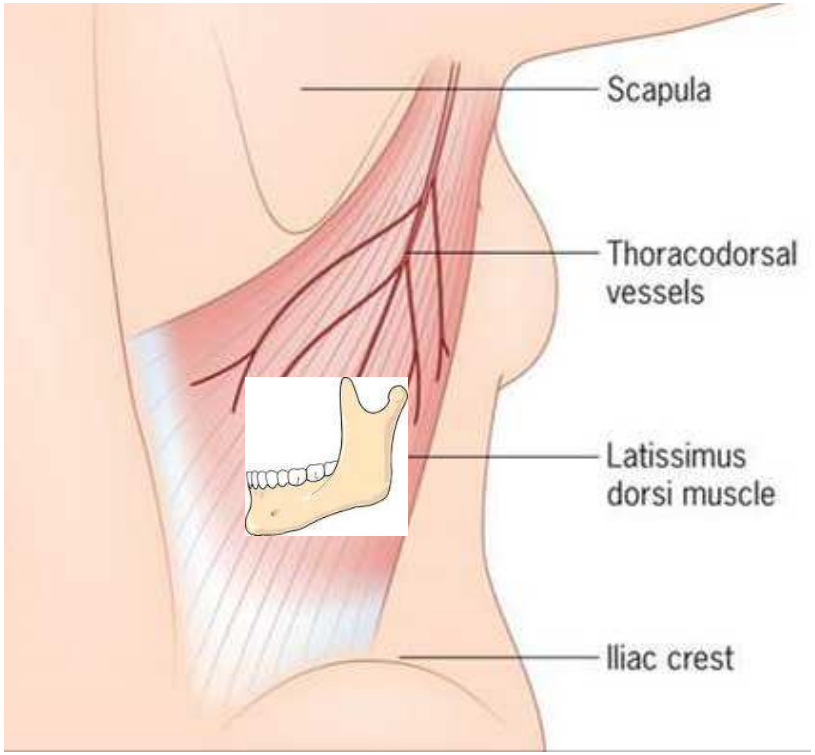








Future



BIOREACTEUR

Conclusion

We must fight on.
The patients are couting on us.

THANK YOU

FOR YOUR ATTENTION