Guided bone regeneration with biphasic calcium phosphate – a pilot study in rats

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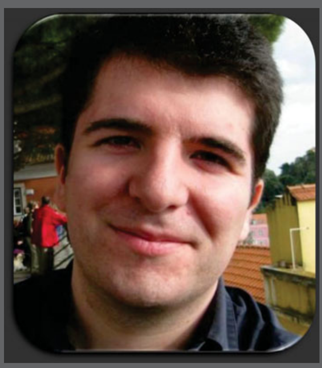

Introduction

The experimental membrane of polyethylene glycol (PEG) intends to overcome the disadvantages of other membranes and shorten surgical time. Several publications proved PEG's: biocompatibility (1, 2); occlusive function (3); ability to prevent collapse (4,5). The synthetic nature of alloplastic grafts allows for an absolute control of production, thus avoiding eventual transfer of pathologies inherent to xeno and allografts (6-7) Biphasic calcium phosphate (BCP) is an aloplastic graft that contains hydroxyapatite and β-tricalcium phosphate.

Objectives

Evaluate the regenerative effect of BCP covered with a PEG membrane and compare the results with the regeneration of defects covered only with the PEG membrane.

Materials and Methods

Two parietal defects with a 5mm diameter were created, with a standardized metal key (Fig.1), in seven Wistar rats 19-21 week old. The control defect (left parietal bone) was covered with a PEG membrane and the test defect (right parietal bone) was filled with 400-700μm diameter granules of BCP - Straumann®BoneCeramic - and covered with PEG membrane - Straumann®MembraGel (Fig.2, 3). After a healing period of two months the animals were sacrificed by inhalation of carbon dioxide and the samples (Fig.4) were processed. The samples were stained with Solochrome for histologic and histomorphometric analysis. The statistical analysis was made with a 95% confidence interval.

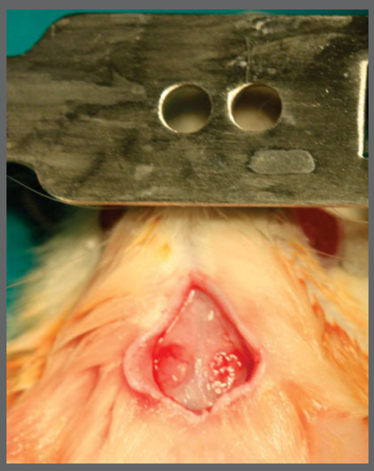

Fig. 1 – Critical defects and standardized metal key.

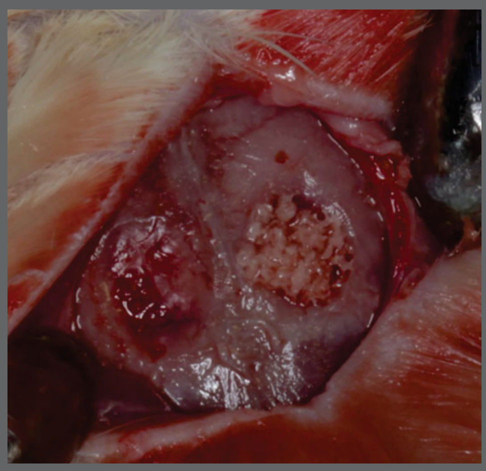

Fig. 2 – Control defect (left) empty and test defect (right) filled with BCP.

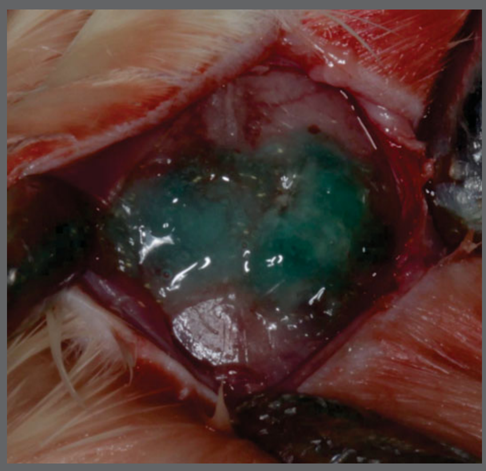

Fig. 3 – Defects covered with the PEG hydrogel membrane.

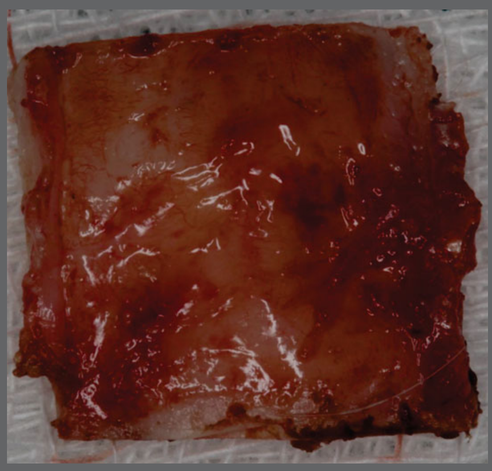

Fig. 4 – Sample of bone tissue harvested from rat calvaria.

Results

Table 1 – Percentage of newly formed bone occupying the defects

Treatment	Mean (CI)
PEG	57.3 (42.7-72.0)
HA/TCP + PEG	61.8 (53.7-69.9)

PEG, polyethylene glycol; HA, hydroxyapatite; TCP, β-tricalciumphosphate; CI, confidence interval

Table 2 – t-test for independent samples

Percentage of the total regenerated area	Levene's Test for Equality of Variances		t-test for Equality of Means						
	F	Sig.	t	df	Sig. (2-tailed)	Mean Diference	Std. Error Diference	95% CI of the diference	
								Lower	Upper
Equal variances assumed	2.864	.104	-.623	24	.539	-4.446	7.130	-19.161	10.270

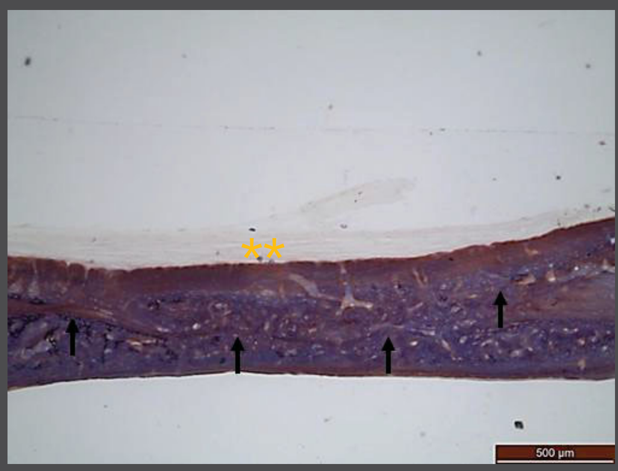

Fig. 5 – Control defect, x50 magnification.

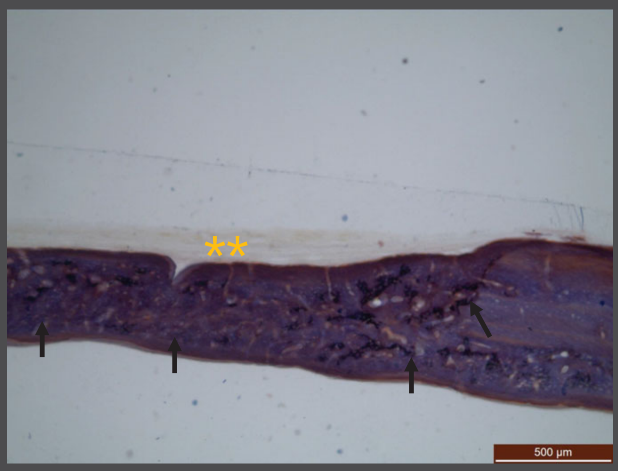

Fig. 6 – Control defect, x50 magnification.

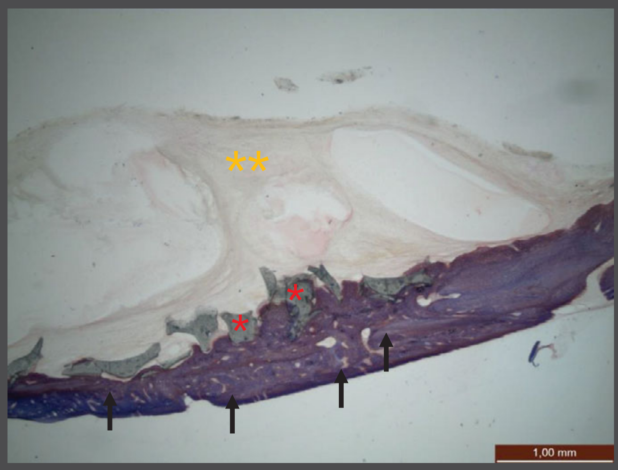

Fig. 7 – Test defect, x25 magnification.

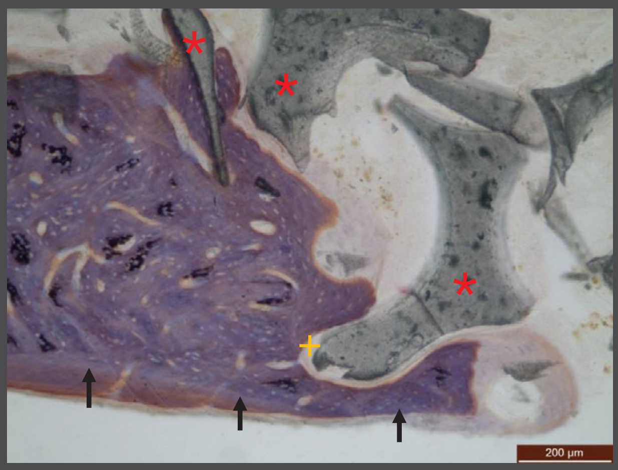

Fig. 8 – Test defect, x100 magnification.

(*) BCP particle
(+) Fibrous tissue
(**) PEG membrane
(→) Neoformation limit

Conclusions

There were no statistically significant differences between the test and the control groups (p=0.539). BCP did not exhibit osteoconductive properties, had a low number of particles incorporated into the neoformed bone, but sustained PEG membrane. The BCP and PEG membrane remained intact after 2 months. The PEG membrane had a fast and easy application, fixed itself, proved to be biocompatible and occlusive.

Clinical Implications

Guided bone regeneration with BCP may not obtain the desired osteoconductive effect. The PEG membrane is a promising membrane that may help reducing the surgical time as well as facilitate the procedures.

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