P-011

Physical properties of Resorbable P(LA/CL) bilayer membrane for GBR

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1. Objectives

Resorbable collagen membrane have been widely used for Guided Bone Regeneration (GBR). However, animal derived collagen may carry a risk of unknown pathogen. In addition, most of the collagen membranes are weak under wet condition and could easily be broken. To overcome these points, we have developed resorbable bilayer membrane using synthetic poly (L-lactide-ε-caprolactone) (PBM, Cytrans ElaShield) with elastic characteristics.

In this study, we aimed to evaluate physical and handing properties of PBM under wet condition.

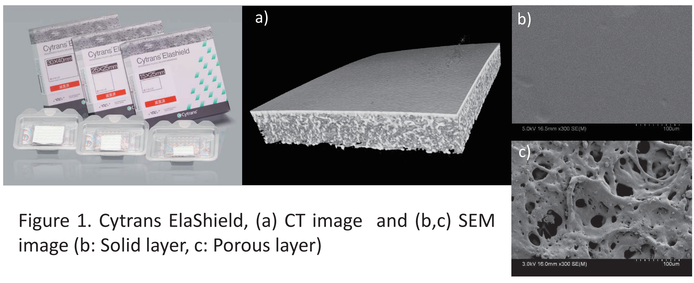


Figure 1. Cytrans ElaShield, (a) CT image and (b,c) SEM image (b: Solid layer, c: Porous layer)

2. Methods

PLGA membrane (PM) and Collagen membrane (CM) were used as control.

【Tensile strength test】

Tensile strength was measured by using universal testing machine (CR-500DX, SUN SCIENTIFIC CO.,LTD) in dry and wet condition (immersing to saline for 1 minutes). Both end of test specimen (2 mm × 15 mm) was fixed with jig, tensile strength was measured at cross head speed of 20 mm/min until the specimen was broken.

【String tear strength test】

String tear strength was measured by using universal testing machine in dry and wet condition. One end of test specimen (6 mm × 15 mm) was fixed with jig, another end thread the suture(SOFTRETCH,4-0, GC). Tear strength was measured at cross head speed of 20 mm/min until the specimen was broken.

【Flexibility】

Flexibility was evaluated by using jaw model. Test specimens (15 mm × 25 mm) in dry and wet condition was placed on jaw model to confirm whether test specimens could fit the shape of jaw model.

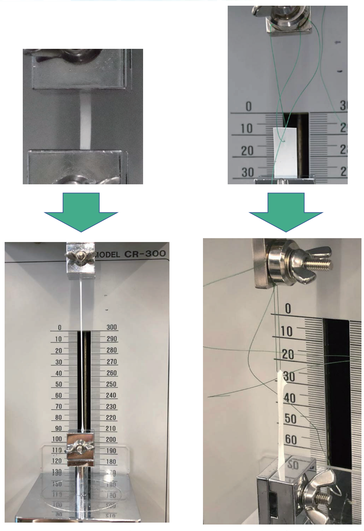


Figure 2. Tensile strength test (Left) and String Tear strength test (Right)

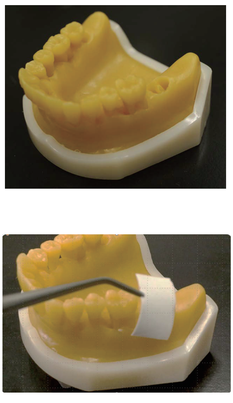


Figure 3. Jaw model

3. Results

【Tensile strength test】

PBM showed elastic characteristic and was broken at longer distance and low tensile strength. No difference between dry and wet condition was observed for PBM and PM. Tensile strength of CM decreased under wet condition (Figure 4).

【String tear strength test】

Results of string tear strength were similar to tensile strength. PBM showed elastic characteristic and was broken at longer distance and low tensile strength. No difference between dry and wet condition was observed for PBM and PM. However tear strength of CM decreased under wet condition (Figure 5).

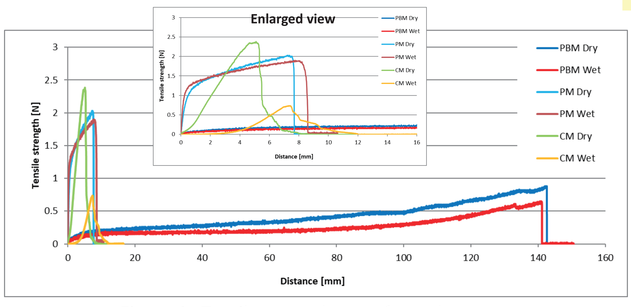


Figure 4. Tensile strength test of membrane

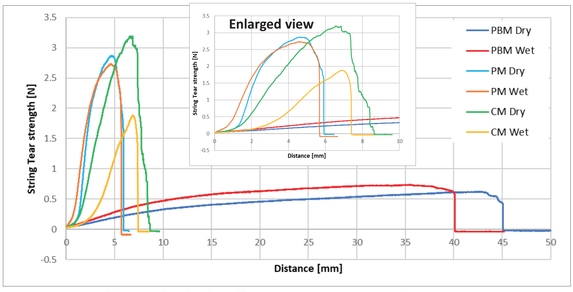


Figure 5. String Tear strength test of membrane

【Flexibility】

PBM in dry condition didn't fit the shape of jaw model, but PBM in wet condition was able to fit the shape by adhering to the surface. PM didn't fit the shape of jaw model even in wet condition due to the solid characteristic. CM in dry condition didn't fit the shape of jaw model, but CM became softer by immersing to saline and fit the shape of jaw model easily.

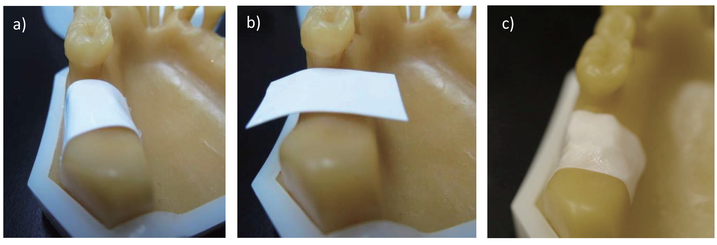
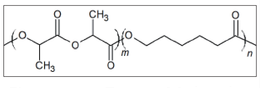


Figure 6. Flexibility of membrane (a: PMB, b: PM, c: CM)

4. Discussion

Elastic and flexible properties PBM showed in these tests are clinically advantage in order to cover bone graft materials during surgery and healing without decreasing strength. PBM is similar in structure to PM but has different elasticity. The elasticity of PBM is considered to be due to the properties of poly (L-lactide-ε-caprolactone). It is presumed that alkyl chain unit in molecular structure of poly(L-lactide-ε-caprolactone) affects its elasticity and resulting in hard to break (Figure 7).



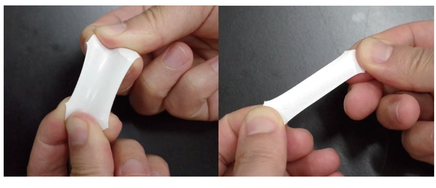


Figure 7. Molecular structure of poly (L-lactide-ε-caprolactone) (Top) and elasticity of PBM (Right)

5. Conclusions

These results indicate that PBM maintains its physical strength and handling properties unchanged even under wet conditions. Therefore, PBM is expected to be a clinically useful membrane for GBR because its strength does not decrease during surgery.