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## Introduction

The principle of guided tissue regeneration (GTR) using a barrier membrane has been used in treatment of periodontal defects for almost 3 decades [1]. More recently the principle of GTR has also been used in guided bone regeneration in various other indications, for example to treat bony defects in dental implantology and also in other areas in the skeleton [2]. One of the criteria needed for barrier membrane is the ability of a barrier membrane to allow tissue ingrowth to the membrane. But at the same time the membrane has to act as a barrier to avoid soft tissue ingrowth through the membrane. The aim of this study was to characterize a developed porous polymeric surface and to investigate the tissue integration performance of the membrane when implanted into a rabbit calvarium.

## Materials and Methods

The polymeric film composed of polylactide, polyglycolide and trimethylene carbonate was first extruded, and further compression moulded into a thickness of 0,2 mm. Thereafter, film specimens were treated with a "dipping" method which was previously developed within this project. In this "dipping" method, the plastic specimen was first immersed into N-methyl-pyrrolidone solution (NMP) for approximately 25 seconds, after which the specimens were allowed to stabilize for approximately 30 minutes. Thereafter scanning electron microscopy (SEM) analysis was performed (Jeol T100, Japan) to obtain images of the membrane structure. *In vivo* testing was performed in rabbits on non-critical size defects (6 mm) in the skull. The membranes were placed above and below the defect. After 4 weeks, the calvarial bones were removed and Goldner stained histosections prepared. From the obtained histosections the tissue integration into the membrane was analysed.

## Results

In Figure 1. porous surfaces of the treated film are clearly visible. The middle layer of the film is dense. The surface of the membrane is highly porous (Figure 2.).

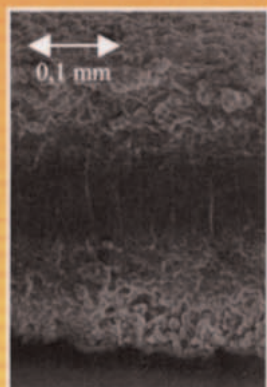


Figure 1. The cross section of the NMP treated membrane.

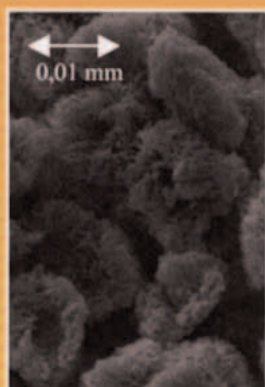


Figure 2. The surface of the NMP treated membrane.

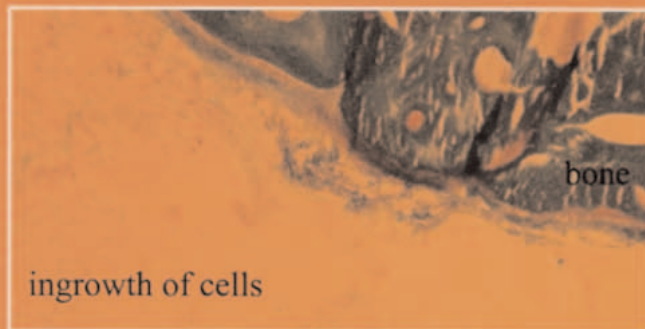


Figure 3. The tissue integration into membrane after 4 weeks healing *in vivo*. Membrane is shown as yellow, bone is shown in green and osteoid red due to the Goldner-Trichrome staining.

The Figure 3. shows the ingrowth of cells into the porous membrane. When in contact with bone, the membrane surface performs as a scaffold, which enables bone integration into the membrane.

## Discussion

The need for tissue integration dictates the incorporation of structural elements in the device promoting tissue ingrowth, while concurrently achieving cell exclusion. Flap stabilization through tissue integration of the membrane prevents wound failure and subsequent epithelialization (formation of a long junctional epithelium) of the ruptured/exposed tooth-gingival flap interface during the early healing sequence. This minimizes gingival recession and device exposure. At the same time the formation of a pocket outside the device is prevented, which in turn reduces the risk for infection. Another benefit of these features is the maintenance of a esthetics during and after the wound healing [3]. With the newly developed method the film membrane is obtained where both of the surfaces have porosity, which allows tissue ingrowth. The middle of the film remains dense, and therefore it forms a cell-exclusive layer, and the penetration of the tissues through the membrane is avoided.

## Conclusions

By the newly developed method a poly(lactide co-polymer) film was treated with N-Methyl pyrrolidone solvent and porous layer was achieved on both surfaces of the polymeric film. The *in vivo* results show good integration of cells into the porous layers of this material.

## References:

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