

INTISARI

Latar belakang. Pemasangan implan gigi sebagian besar disertai perawatan preprostetik dan prosedur yang paling umum dilakukan adalah *guided bone regeneration* (GBR). Membran kolagen banyak digunakan pada prosedur GBR, memiliki kekurangan antara lain tidak bersifat antimikroba, pembentukan tulang lama, lunak dan mudah sobek sehingga kurang menjaga dimensi daerah augmentasi. Fibroin *Bombyx mori L.* memiliki potensi sebagai material antibakteri, memacu pertumbuhan tulang dan biokompatibel. Tujuan penelitian ini adalah mempelajari pengaruh pelapisan fibroin *Bombyx mori L.* terhadap sifat fisik, mekanik, biologi membran kolagen serta kecepatan dan kualitas pembentukan tulang.

Metode penelitian. Jenis penelitian ini terdiri dari deskriptif observasional karakter membran kolagen dan eksperimental laboratoris invitro dan invivo. Penelitian karakter membran kolagen terdiri dari analisis karakter partikel fibroin, pengamatan morfologi membran kolagen, analisis gugus fungsi dan komposisi unsur. Penelitian invitro mencakup hidrofobisitas, kekasaran permukaan, daya antibakteri dan kekuatan tarik. Sampel terdiri dari kelompok K0 (membran kolagen tanpa pelapisan) dan kelompok membran kolagen dilapisi fibroin *Bombyx mori L.* 1 kali dengan proses *dip-coating* (kelompok K1), kelompok K2 (2 kali pelapisan) dan kelompok K3 (3 kali pelapisan). Data dianalisis secara statistik menggunakan ANAVA satu jalur ($p < 0,05$). Penelitian invivo mencakup pengamatan kecepatan dan kualitas pembentukan tulang baru. Sampel terdiri dari kelompok K0 (membran kolagen tanpa pelapisan) dan kelompok K2 (2 kali pelapisan fibroin). Pengamatan dilakukan pada hari ke-0, 14 dan 28. Data dianalisis secara statistik menggunakan ANAVA dua jalur ($p < 0,05$).

Hasil dan kesimpulan. Hasil penelitian karakter membran kolagen menunjukkan partikel fibroin cenderung homogen, terdapat serat fibroin pada permukaan membran, pelapisan membran kolagen dengan fibroin *Bombyx mori L.* meningkatkan intensitas serapan gugus -OH, -CH₂, -C=O, C-C, dan C-N pada spektra inframerah dan terdapat peningkatan masa unsur N dan O setelah pelapisan. Penelitian invitro menunjukkan hasil peningkatan kekasaran permukaan, peningkatan hidrofobisitas, peningkatan kekuatan tarik dan penurunan pertumbuhan *F. nukleatum* setelah pelapisan fibroin. Hasil penelitian invivo menunjukkan bahwa sampel kelompok K2 memiliki jumlah osteoblas dan ekspresi ALP lebih banyak daripada sampel K0 setelah prosedur GBR pada hewan coba tikus *Sprague Dawley* hari ke-14 dan 28. Kesimpulan penelitian ini adalah bahwa pelapisan fibroin *Bombyx mori L.* mampu meningkatkan sifat fisik, mekanik dan biologis membran kolagen, serta meningkatkan kecepatan dan kualitas pembentukan tulang pada perawatan preprostetik implan gigi dengan prosedur *guided bone regeneration*.

Kata kunci : fibroin *Bombyx mori L.*, membran kolagen, *guided bone regeneration*, perawatan preprostetik.

ABSTRACT

Background: Dental implant placement is often accompanied by pre-prosthetic treatments, with guided bone regeneration (GBR) being one of the most commonly performed procedures. Collagen membranes are widely used in GBR procedures but have several limitations, including a lack of antimicrobial properties, delayed bone formation, low mechanical strength, and susceptibility to tearing, which makes them less effective in maintaining the augmented area dimensions. *Bombyx mori* L. fibroin has potential as an antibacterial, osteoinductive, and biocompatible biomaterial. The objective of this study was to investigate the effect of *Bombyx mori* L. fibroin coating on the physical, mechanical, and biological properties of collagen membranes, as well as the rate and quality of bone formation.

Methods: This research comprised a descriptive observational study of collagen membrane characteristics, as well as an in vitro and in vivo laboratory experimental study. The characterization of collagen membranes included fibroin particle analysis, observation of membrane morphology, functional group analysis, and assessment of elemental composition. The in vitro study examined hydrophobicity, surface roughness, antibacterial activity, and tensile strength. Samples consisted of a control group (K0: uncoated collagen membrane) and treatment groups in which the collagen membranes were coated with *Bombyx mori* L. fibroin using a dip-coating process: once (K1), twice (K2), and three times (K3). Data were statistically analyzed using one-way ANOVA ($p < 0.05$). The in vivo study evaluated the rate and quality of new bone formation. Samples consisted of group K0 (uncoated collagen membrane) and group K2 (collagen membrane coated twice with fibroin). Observations were made on days 0, 14, and 28. Data were statistically analyzed using two-way ANOVA ($p < 0.05$).

Results and Conclusion: The characterization of the collagen membranes showed that the fibroin particles were relatively homogeneous, fibroin fibers were present on the membrane surface, and coating the collagen membranes with *Bombyx mori* L. fibroin increased the infrared absorption intensity of -OH, -CH₂, -C=O, C-C, and C-N functional groups. An increase in the mass of nitrogen and oxygen elements was also observed post-coating. The in vitro study demonstrated enhanced surface roughness, increased hydrophobicity, improved tensile strength, and a reduction in the growth of *Fusobacterium nucleatum* following fibroin coating. The in vivo study revealed that the K2 group had a higher number of osteoblasts and increased ALP expression compared to the K0 group on days 14 and 28 after GBR procedures in *Sprague Dawley* rats. This study concludes that *Bombyx mori* L. fibroin coating enhances the physical, mechanical, and biological properties of collagen membranes, thereby improving the rate and quality of bone formation in pre-prosthetic dental implant treatments involving guided bone regeneration.

Keywords: Bombyx mori L. fibroin, Collagen membrane, Guided bone regeneration.