

INTISARI

Regenerasi jaringan periodontal adalah salah satu tantangan dalam perawatan periodontitis. Keberhasilan rekayasa jaringan periodontal sangat bergantung pada biomaterial perancah (*scaffold*) yang memiliki karakteristik morfologi pori seperti ukuran pori, porositas, dan interkoneksi yang dapat mendukung migrasi sel, difusi nutrisi, dan pembentukan jaringan baru. Hidrogel kolagen-kitosan merupakan biomaterial dengan biokompatibilitas dan porositas tinggi, sementara *injectable platelet-rich fibrin* (i-PRF) merupakan konsentrat autologous yang kaya growth factor dan memiliki kemampuan regeneratif. Kombinasi kedua bahan tersebut diperkirakan dapat memodifikasi struktur mikro *scaffold* dan meningkatkan potensi regeneratifnya. Penelitian ini bertujuan untuk mengetahui pengaruh pencampuran hidrogel kolagen-kitosan dengan i-PRF terhadap morfologi pori bahan regeneratif periodontal melalui pengamatan dengan *Scanning Electron Microscope* (SEM).

Sebanyak 27 sampel dibagi menjadi tiga kelompok, yaitu hidrogel kolagen-kitosan, i-PRF dan hidrogel kolagen-kitosan + i-PRF. Setiap sampel dianalisis ukuran pori (μm) dan porositas (%) menggunakan perangkat lunak *ImageJ* melalui segmentasi citra SEM. Data diuji normalitas dengan *Shapiro-Wilk* dan homogenitas varians dengan *Levene Test*. Ukuran pori dianalisis menggunakan *Welch ANOVA* dan *post hoc Games-Howell*. Porositas dianalisis menggunakan *One Way ANOVA* dan uji lanjut *Tukey HSD*.

Hasil penelitian menunjukkan adanya perbedaan signifikan ($p < 0,05$) pada ukuran pori dan porositas antar kelompok. Hidrogel kolagen-kitosan memperlihatkan ukuran pori paling besar, i-PRF memiliki ukuran pori paling kecil, dan hidrogel kolagen-kitosan + i-PRF menunjukkan ukuran pori yang berada di antara kedua kelompok tersebut. Pada aspek porositas, hidrogel kolagen-kitosan menunjukkan nilai paling rendah, i-PRF memberikan nilai paling tinggi, sementara hidrogel kolagen-kitosan + i-PRF memperlihatkan porositas menengah. Uji *post hoc Games-Howell* dan *Tukey HSD* menyatakan bahwa seluruh kelompok berbeda signifikan satu sama lain. Kesimpulan penelitian ini adalah pencampuran hidrogel kolagen-kitosan dengan i-PRF berpengaruh mengurangi ukuran pori dan meningkatkan porositas bahan regeneratif periodontal.

Kata kunci: hidrogel kolagen-kitosan, i-PRF, morfologi pori, regenerasi periodontal, SEM.

ABSTRACT

Periodontal tissue regeneration is a challenge in periodontitis treatment. The success of periodontal tissue engineering relies heavily on scaffold biomaterials with pore morphological characteristics such as pore size, porosity, and interconnectivity that can support cell migration, nutrient diffusion, and new tissue formation. Collagen–chitosan hydrogel is a biomaterial with high biocompatibility and porosity, while injectable platelet-rich fibrin (i-PRF) is an autologous concentrate rich in growth factors and possesses regenerative properties. The combination of these two materials is expected to modify the scaffold microstructure and enhance its regenerative potential. This study aimed to determine the effect of mixing collagen–chitosan hydrogel with i-PRF on the pore morphology of periodontal regenerative materials through Scanning Electron Microscope (SEM) observations.

A total of 27 samples were divided into three groups: collagen–chitosan hydrogel, i-PRF, and collagen–chitosan hydrogel + i-PRF. Each sample was analyzed for pore size (μm) and porosity (%) using ImageJ software through SEM image segmentation. Data were tested for normality using the Shapiro–Wilk test and for homogeneity of variance using the Levene test. Pore size was analyzed using Welch's ANOVA and the Games–Howell post hoc test. Porosity was analyzed using one-way ANOVA and the Tukey HSD test.

The results showed significant differences ($p < 0.05$) in pore size and porosity between groups. The collagen–chitosan hydrogel showed the largest pore size, the i-PRF hydrogel showed the smallest pore size, and the collagen–chitosan hydrogel + i-PRF hydrogel showed pore sizes intermediate between the two groups. In terms of porosity, the collagen–chitosan hydrogel showed the lowest value, the i-PRF hydrogel showed the highest value, while the collagen–chitosan hydrogel + i-PRF hydrogel showed intermediate porosity. The Games–Howell post hoc test and the Tukey HSD test confirmed that all groups were significantly different from each other. The conclusion of this study is that mixing collagen–chitosan hydrogel with i-PRF has an effect on has the effect of reducing pore size and increasing the porosity of periodontal regenerative materials.

Keywords: collagen–chitosan hydrogel, i-PRF, pore morphology, periodontal regeneration, SEM.