INTISARI

Teknologi manufaktur aditif menjadi terobosan inovasi dalam pembuatan basis gigi tiruan karena menawarkan banyak keunggulan dibandingkan teknik konvensional. Perubahan teknik fabrikasi berpotensi memengaruhi sifat permukaan basis gigi tiruan yang berperan penting dalam pembentukan biofilm. Penelitian ini bertujuan untuk mengetahui pembentukan biofilm *Streptococcus mutans* dan *Candida albicans* pada permukaan basis gigi tiruan yang difabrikasi dengan teknik manufaktur aditif

Penelitian ini menggunakan desain eksperimental laboratoris untuk membandingkan tiga kelompok (n = 7 per kelompok), yaitu konvensional (*heat cured)*, manufaktur aditif *vat polymerization* dengan *layer thickness* 50 μm (3D LT 50) dan 100 μm (3D LT 100). Sampel penelitian berbentuk silinder dengan diameter 5 mm dan tinggi 2 mm. Pengujian meliputi pengukuran kekasaran permukaan, pengamatan topografi permukaan, pengukuran sudut kontak untuk *wettability*, dan kuantifikasi densitas biofilm ko-spesies *Streptococcus mutans* dan *Candida albicans* dengan model dinamis. Analisis statistik dilakukan dengan *oneway ANOVA* ($p < 0,05$).

Hasil penelitian menunjukkan variasi sifat fisik permukaan yang signifikan antar kelompok. Kekasaran permukaan mengungkapkan bahwa kelompok 3D LT 50 memiliki nilai kekasaran terendah (Ra = 0,77 ± 0,18 μm) dan kelompok 3D LT 100 dengan nilai tertinggi (Ra = 2,45 ± 0,23 μm). Pengamatan topografi dengan SEM menunjukkan kelompok 3D LT 50 memiliki permukaan alur yang rata, halus, dan teratur, kelompok 3D LT 100 menunjukkan alur yang lebih kasar dan lebar sementara kelompok konvensional menunjukkan *scratch marks* hasil pemolesan yang sangat bergantung operator. Aspek *wettability*, kelompok konvensional memiliki sifat hidrofobik (97,20 ± 2,45^o), sedangkan kelompok 3D LT 50 dan 3D LT 100 menunjukkan sifat hidrofilik (76,61 ± 2,4^o dan 76,28 ± 4,72^o). Hasil densitas biofilm menunjukkan bahwa kelompok 3D LT 50 (0,48 ± 0,07) memiliki densitas biofilm terendah, diikuti kelompok konvensional (0,83 ± 0,16), dan kelompok 3D LT 100 (1,04 ± 0,24) dengan densitas tertinggi. Kesimpulannya, metode manufaktur aditif dengan parameter cetak *layer thickness* 50 μm menunjukaan pembentukan biofilm *S. mutans* dan *C. albicans* terendah pada permukaan basis gigi tiruan dibandingkan metode konvensional.

Kata kunci: manufaktur aditif; basis gigi tiruan; biofilm; *Streptococcus mutans*; *Candida albicans*.

ABSTRACT

Additive manufacturing technology has emerged as an innovative advance in the fabrication of denture bases, offering several advantages over conventional techniques. Fabrication methods may alter the surface properties of the denture bases, which play a critical role in biofilm formation. This study aimed to investigate the formation of co-species biofilms of *Streptococcus mutans* and *Candida albicans* on denture base surfaces fabricated by additive manufacturing.

An in vitro experimental study was conducted to compare three groups (n = 7 per group): conventional heat-cured resin (conventional), vat-polymerization additive manufacturing with layer thickness of 50 μm (3D LT 50), and layer thickness of 100 μm (3D LT 100). Cylindrical specimens (5 mm diameter × 2 mm height) were prepared. Surface roughness (Ra) was measured, surface topography was examined by scanning electron microscopy (SEM), contact angle measurements were performed to assess wettability, and the density of co-species biofilms of *S. mutans* and *C. albicans* was quantified using a dynamic biofilm model. Statistical analysis was performed using one-way ANOVA with significance set $p < 0.05$.

Significant differences in surface physical properties were observed among the groups. Surface roughness values were lowest in the 3D LT 50 group (Ra = 0.77 ± 0.18 μm) and highest in the 3D LT 100 group (Ra = 2.45 ± 0.23 μm). SEM revealed that surfaces in the 3D LT 50 group were smooth, even, and regular; the 3D LT 100 group exhibited coarser and wider grooves; and the conventional group displayed polishing-induced scratch marks that were highly operator dependent. Regarding wettability, the conventional group demonstrated hydrophobic behavior (97.20 ± 2.45°), while the 3D LT 50 and 3D LT 100 groups were hydrophilic (76.61 ± 2.40° and 76.28 ± 4.72°). Biofilm density measurements showed that the 3D LT 50 group (0.48 ± 0.07) had the lowest biofilm density, followed by the conventional group (0.83 ± 0.16), and the 3D LT 100 group (1.04 ± 0.24) which had the highest density. In conclusions, additive manufacturing with 50 μm layer thickness showed the smallest formation of *S. mutans* and *C. albicans* biofilms on denture base surfaces compared with conventional fabrication methods.

Keywords: additive manufacturing; denture base; biofilm; *Streptococcus mutans*; *Candida albicans*.