

ABSTRAK

Nama : Nabila Rifani Nasution
Program Studi : Kedokteran Gigi
Judul : Pengaruh *Exposure Time Per Layer* terhadap Akurasi Dimensi dan *Flexural Strength* pada Basis Gigi Tiruan *3D Printing*

Teknologi 3D printing berbasis Computer-Aided Design/Computer-Aided Manufacturing (CAD/CAM) banyak digunakan dalam pembuatan basis gigi tiruan karena presisi dan efisiensinya. Namun, kualitas hasil cetak sangat dipengaruhi oleh parameter pencetakan, khususnya *exposure time per layer* yang berperan dalam proses polimerisasi resin fotopolimer. Penelitian ini bertujuan menganalisis pengaruh *exposure time per layer* terhadap akurasi dimensi dan *flexural strength* basis gigi tiruan yang difabrikasi menggunakan teknologi 3D printing *open system*. Penelitian eksperimental laboratoris ini menggunakan desain *post-test only control group*. Basis gigi tiruan dicetak menggunakan *open system* dengan variasi *exposure time* 4,5; 5; dan 5,5 detik, serta dibandingkan dengan 3D printing *close system* dan resin akrilik polimerisasi panas (RAPP). Akurasi dimensi diukur pada parameter panjang, lebar, dan tinggi, sedangkan *flexural strength* diuji menggunakan metode *three-point bending test*. Analisis statistik dilakukan menggunakan uji ANOVA Welch dan uji lanjut Tukey ($\alpha = 0,05$). Hasil menunjukkan bahwa *exposure time per layer* berpengaruh signifikan terhadap akurasi dimensi dan *flexural strength* ($p = 0,000$). Pada sistem *open system*, nilai akurasi panjang tertinggi diperoleh pada *exposure time* 5,5 detik ($64,99 \pm 0,07$ mm), diikuti 4,5 detik ($64,98 \pm 0,09$ mm) dan 5 detik ($64,94 \pm 0,05$ mm). Nilai *flexural strength* tertinggi pada *open system* diperoleh pada *exposure time* 4,5 detik ($68,90 \pm 1,27$ MPa), diikuti 5,5 detik ($67,29 \pm 1,49$ MPa) dan 5 detik ($66,08 \pm 2,32$ MPa). Kelompok *close system* menunjukkan nilai *flexural strength* tertinggi ($90,61 \pm 2,72$ MPa), sedangkan RAPP sebesar $73,76 \pm 3,60$ MPa. Disimpulkan bahwa pengaturan *exposure time per layer* berperan penting dalam optimasi akurasi dimensi dan sifat mekanik basis gigi tiruan hasil 3D printing.

Kata kunci: 3D printing, *exposure time per layer*, akurasi dimensi, *flexural strength*, basis gigi tiruan.

ABSTRACT

Name : Nabila Rifani Nasution
Study Programme : Dentistry
Title : *The Effect of Exposure Time Per Layer on Dimensional Accuracy and Flexural Strength of 3D-Printed Denture Bases*

Three-dimensional (3D) printing based on Computer-Aided Design/Computer-Aided Manufacturing (CAD/CAM) is widely used in denture base fabrication due to its high precision and efficiency. However, print quality is strongly influenced by printing parameters, particularly exposure time per layer, which governs the polymerization of photopolymer resin. This study aimed to analyze the effect of exposure time per layer on dimensional accuracy and flexural strength of denture bases fabricated using an open-system 3D printer.

This experimental laboratory study employed a post-test only control group design. Denture bases were fabricated using an open system with exposure times of 4.5, 5, and 5.5 seconds, and were compared with a closed-system 3D printer and heat-polymerized acrylic resin (HPAR). Dimensional accuracy was evaluated in terms of length, width, and height, while flexural strength was assessed using a three-point bending test. Statistical analysis was performed using Welch ANOVA followed by Tukey post-hoc tests ($\alpha = 0.05$). The results demonstrated that exposure time per layer significantly affected dimensional accuracy and flexural strength ($p = 0.000$). In the open system, the highest dimensional accuracy in length was observed at an exposure time of 5.5 seconds (64.99 ± 0.07 mm), followed by 4.5 seconds (64.98 ± 0.09 mm) and 5 seconds (64.94 ± 0.05 mm). The highest flexural strength within the open system was obtained at 4.5 seconds (68.90 ± 1.27 MPa), followed by 5.5 seconds (67.29 ± 1.49 MPa) and 5 seconds (66.08 ± 2.32 MPa). The closed system exhibited the highest overall flexural strength (90.61 ± 2.72 MPa), while HPAR showed a value of 73.76 ± 3.60 MPa. It is concluded that optimization of exposure time per layer is critical for improving dimensional accuracy and mechanical properties of 3D-printed denture bases.

Keywords: *3D printing, exposure time per layer, dimensional accuracy, flexural strength, denture base.*