

## INTISARI

Perawatan saluran akar merupakan salah satu perawatan di bidang kedokteran gigi yang memiliki tiga tahap yaitu preparasi, sterilisasi, dan obturasi. Instrumen endodontik yang direkomendasikan dalam prosedur preparasi saluran akar adalah *file* Nikel Titanium (NiTi) putar. Keberhasilan *file* endodontik bergantung pada desain geometrinya. Penelitian dilakukan dengan pengamatan *in silico* serta modifikasi 5 faktor desain geometri file taper NiTi putar meliputi bentuk penampang, diameter pangkal, jumlah *pitch*, kekerucutan, dan kecepatan putaran untuk melihat defleksi, tegangan, dan kelelahan siklik dari *file*.

Tujuan untuk mengetahui pengaruh desain geometri file taper NiTi putar serta interaksi antar variabel terhadap bentuk preparasi saluran akar yang adekuat.

Penelitian *in silico* menggunakan 3 jenis File NiTi putar kontinyu diameter 0,25 mm dengan bentuk penampang yang berbeda (*Pro Taper Next X2*, *Pro Taper Gold F2* dan *Hyflex*). Ketiga jenis *file* dipindai secara 3D dengan  $\mu$ -CT Scanner Skyscan 1173 *High Energy Micro CT* dilanjutkan proses CAD menggunakan Autodesk Inventor Professional 2020. Tiap kelompok diberi perlakuan berupa perubahan diameter, jumlah ulir, dan kekerucutan. Selanjutnya dilakukan proses simulasi *cyclic fatigue*, kecepatan, fleksibilitas, dan kemampuan pengikisan menggunakan perangkat lunak ANSYS Structural 18.2.

Anova 3 jalur menunjukkan hasil yang bermakna ( $\text{sig}=0,000$ ) pada semua variabel terpengaruh dan setiap 5 faktornya. Defleksi dan fleksibilitas terbesar diperoleh pada file dengan bentuk penampang segi tiga cembung. Tegangan pada file desain persegi lebih kecil dibandingkan segi tiga cembung. Kecepatan dan jumlah *pitch* yang kecil menghasilkan tegangan dan kelelahan siklik yang lebih baik. Redisain modifikasi *file taper* NiTi putar penampang segi empat yang diharapkan akan menjadi perbaikan dari instrument komersiil yang sudah beredar di pasaran.

**Kata Kunci:** NiTi *file*, *In silico*, Geometri *file*, Perawatan saluran akar

## ABSTRACT

Root canal treatment has three treatment phases: root canal preparation, sterilisation, and obturation. The recommended endodontic instrument is rotary Nickel Titanium (NiTi) file. The success of the performance of endodontic file depends on its geometrical design. Research was done in silico to observe and modify 5 factors of geometrical design of rotary NiTi file, such as cross-sectional design, shaft diameter, number of pitches, tapering degree, dan rotary speed to test deflection, tension, and cyclic fatigue.

The aim of research the effect of geometrical design of rotary tapered NiTi file and the interaction between variables to adequate shape of root canal preparation.

In silico research using 3 types of rotary NiTi file with tip diameter 0,25 mm with various cross-sectional design (Pro Taper Next X2, Pro Taper Gold F2 dan Hyflex). All files were 3D scanned using  $\mu$ -CT Scanner Skyscan 1173 High Energy Micro CT, then were processed using CAD Autodesk Inventor Professional 2020. All groups were given treatments such as diameter modification, number of pitch, and tapering degree. Simulation was performed to test *cyclic fatigue*, speed, flexibility, and cutting effectivity using ANSYS Structural 18.2 software.

Three-way Anova showed significant result ( $\text{sig}=0,000$ ) in dependent variables and each of its five factors. Biggest value of deflection and flexibility were found in triangular convex file. Tension of square-shaped file was less than triangular convex file. Slower rotary speed and lesser number of pitches performed better tension and cyclic fatigue. The redesign of the modified of file tapered NiTi rotary with a rectangular cross section is expected to be an improvement from commercial instruments already on the market.

**Keywords:** NiTi file, in silico, file geometry, root canal treatmen