

**Republic of Iraq
Ministry of Higher Education
and Scientific Research
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College of Dentistry**



Detection of Orthodontically Induced Inflammatory Root Resorption from Gingival Crevicular Fluid by Proteomics Analysis

A thesis
submitted to the council of the College of Dentistry/
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Orthodontics

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Abstract

Background: Orthodontically induced inflammatory root resorption is an unpredictable sequela of orthodontic tooth movement cannot be overlooked. Its early detection is the main hope but, because of the adverse effects of sequential radiation doses with more frequent radiography, it cannot be examined on a regular basis.

Aim of the study: This study aimed to identify potential biomarkers in gingival crevicular fluid associated with early orthodontically induced inflammatory root resorption.

Participants and methods: Adults participants with age range 18-32years, who needed bilateral extraction of upper first premolars as part of their orthodontic treatment, were recruited. The right and left upper premolars were randomly assigned with 1:1 allocation ratio, to be subjected to either light force 25g or heavy force 225g sectional fixed appliances. Gingival crevicular fluid was collected at baseline, 1hr, 1day, 7days, 14days, 21days and 28days after force application. To specify the experimental results, gingival crevicular fluid samples were also collected from deep pockets of adult participants, with an age range of 35 - 42years, having chronic periodontitis. At day 28, the teeth were extracted and surface area (μm^2) of resorption craters was measured blindly by absolute straight-on images captured using stereozoom light microscopy. To allocate the collected fluid into either high or low resorption group, regardless of applied force magnitudes, the total percentage (%) of resorption surface area per each tooth was compared. Meanwhile, protein abundance identification was carried out for the pooled samples of both resorption group at baseline, 14days and 28days time points and chronic periodontitis group using two-dimensional gel

electrophoresis coupled with Matrix Assisted Laser Desorption Ionization Time of Flight/ Time of Flight Mass Spectrometer.

Results: Twenty orthodontic participants were enrolled for this study and eighteen of those were analyzed (7 males and 11 females) with mean age of 21.1 ± 3.1 years. No significant difference in the baseline characteristics of roots length and resorption index between the force studied groups ($P > 0.05$). Three folds of significant increase of the total resorption percentage was observed at heavy force group comparing to light force (27.50% vs 9.50%, respectively). A total of 39-spots were found to be commonly present at all gels of both studied groups. Eight out of nineteen spots have been identified proteins with significant changes in their abundance compared to baseline. There was significant upregulation in the abundance of 5 proteins (ANOVA, $P \leq 0.05$) in high resorption group compared to baseline and to the other groups at different time-points. The protein S100A9, extracellular calcium sensing receptor and keratin cytoskeleton exhibited upregulation in high resorption group at 14 days. Meanwhile, the upregulation of immunoglobulin kappa, neutrophil gelatinase-associated lipocalin and keratin cytoskeleton after 28 days of force application suggested a response to inflammatory process, innate-immunity activation along with epithelial cell breakdown throughout the study.

Conclusions: The identified proteins may be the possible early biomarkers of orthodontically induced inflammatory root resorption because their respective protein abundance and expected orthodontic roles increase.



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تحليل بروتينات سائل عنق اللثة للكشف عن تآكل جذور الأسنان الالتهابي الناجم عن تقويم الأسنان

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