



Age-related PDL Cell Proliferation after Different Durations of Orthodontic Loading



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Introduction

Proliferative activity of periodontal ligament (PDL) cells decreases with age in an animal model.¹ Furthermore, human PDL is less cellular in adults than in children.² However, there is no quantitative human PDL assessment related to the effect of age on PDL cell proliferation under different durations of orthodontic loading.

Aim of Study

To determine the differences in proliferative activity of PDL cells on the root surfaces of orthodontically-loaded teeth between younger and older patients after different loading periods.

Materials and Methods

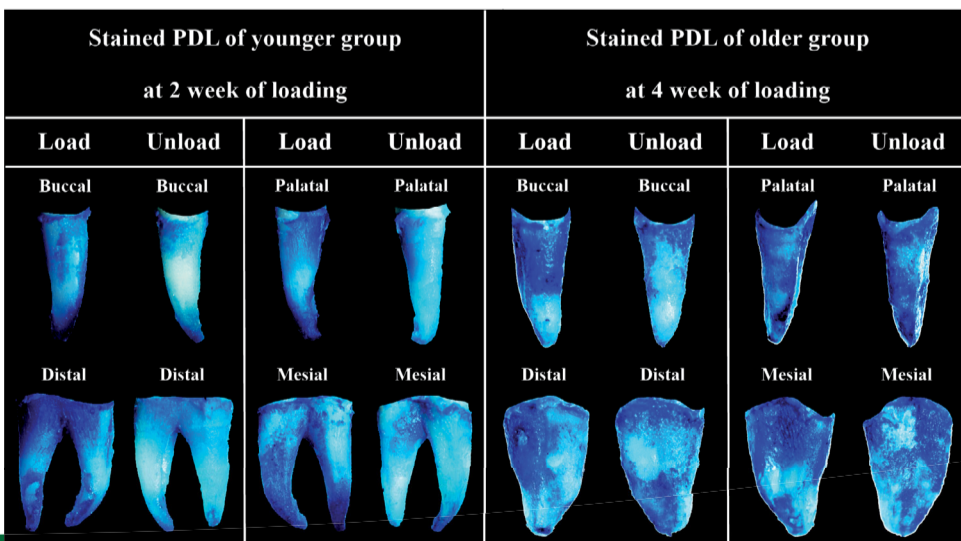
Fifty-eight patients, requiring premolar extraction for orthodontic treatment, were divided into two groups ; a younger group (age15-20) and an older group (age>20). 0.016-inch improved superelastic nickel-titanium alloy wires were used for loading. One of their first premolars was loaded for one, two, four, six, or eight weeks, whereas the contralateral premolar was not loaded, as a control.



Figure 1. Premolar extractions were performed and Extracted premolars were fixed with 10% buffered formalin and stained with toluidine blue.

Digitised images of the root surface were recorded under a stereomicroscope, and the percentage of stained PDL was analysed using ImageJ software. Differences in the percentage of stained PDL between loaded and unloaded teeth for the different durations of loading were analysed using the independent t-test. P-values less than 0.05 were considered statistically significant.

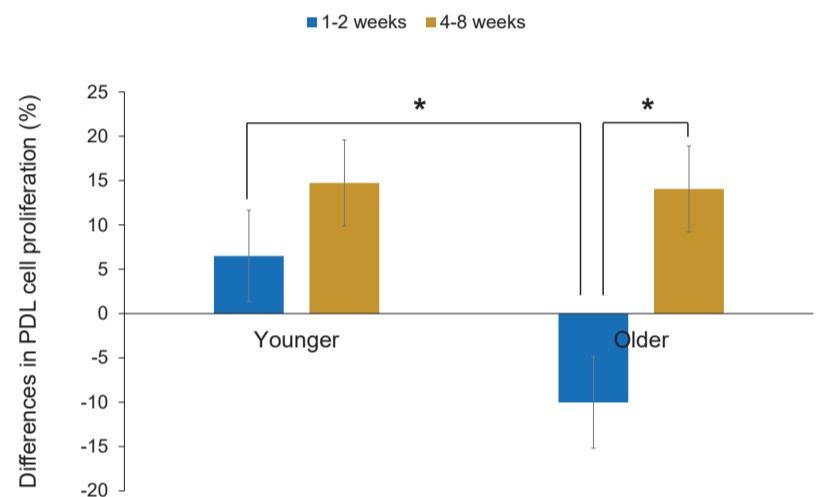
Figure 2. Images of stained PDL with toluidine blue on four root surfaces between younger and older group



Results

The percentage of PDL cell proliferation was significantly greater in the younger group than in the older group after loading for short durations (1-2 weeks) ($p<0.05$) but not after long durations (4-8 weeks). In the older group, we found loading for long durations significantly increased the percentage of PDL cell proliferation than did short duration loading ($p<0.05$).

Figure3. Significant PDL cell proliferation upon orthodontic loading for 1-2 weeks in the younger group and for at least 4 weeks in the older group. * indicates a statistically significant difference at $p<0.05$



Discussion

In terms of the response of PDL cell proliferation to orthodontic loading, our study illustrated that after one to two weeks of loading, there were significantly greater amounts of human PDL cell proliferation in the younger group than in the older group. This finding corresponds with that demonstrated by Kyomen and Tanne,³ in which proliferative activity of PDL cells was greater in young rats than in adult rats. These authors also reported that the proliferative activity of PDL cells with aging may relate to tooth movement.

Staining with toluidine blue is usually recommended to detect cell proliferation,⁴ so stained PDL tissue on the root surface represents PDL cell proliferation.

Our findings about the response of PDL cells with age for optimal durations of orthodontic loading may be beneficial for further study.

Conclusions

In terms of proliferative rate, the PDL cells of younger patients respond to orthodontic force faster than those of older ones.

References

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