Vertical root fractures cannot be treated and result in tooth extraction. Recent studies have reported a significant reduction in fracture resistance of the root dentin with increasing dentin sclerosis and patient age, which appears to result from changes in the microstructure, chemical composition and increase in collagen crosslinking. Nevertheless, the role of odontoblast in the process of sclerosis and the degradation in strength of dentin is unknown. We hypothesize that odontoblast apoptosis may be responsible for the development of sclerotic dentin and degradation in mechanical properties of root dentin.

Introduction
Vertical root fractures cannot be treated and result in tooth extraction. Recent studies have reported a significant reduction in fracture resistance of the root dentin with increasing dentin sclerosis and patient age, which appears to result from changes in the microstructure, chemical composition and increase in collagen crosslinking. Nevertheless, the role of odontoblast in the process of sclerosis and the degradation in strength of dentin is unknown. We hypothesize that odontoblast apoptosis may be responsible for the development of sclerotic dentin and degradation in mechanical properties of root dentin.

Objectives
To evaluate the extent of odontoblast apoptosis along the radial direction of roots from teeth of different ages and assess the mechanical behavior of corresponding dentin.

Methods
➢ 24 extracted human non-carious, vital teeth were obtained with approved protocol and divided into young (age≤ 25, n=12) and old (age≥60, n=12) groups.
➢ Immediately after extraction, half of the teeth were fixed in 10% formaldehyde solution, decalcified by Morse’s solution, and processed for immunohistochemistry.
➢ Odontoblast apoptosis was determined by cleaved caspase-3 immunostaining and assessed using IMAGEJ software in the outer dentin, inner dentin, pulp chamber wall and pulp.
➢ Specimens prepared from the other half of the teeth were evaluated by nanoscopic Dynamic Mechanical Analysis (nanoDMA) in scanning mode.

Results
➢ There were no significant differences in odontoblast apoptosis staining in pulp chamber wall between the young and old teeth. However, the apoptosis staining was significantly higher in outer dentin, inner dentin, pulp chamber wall and pulp.
➢ Specimens prepared from the other half of the teeth were evaluated by nanoscopic Dynamic Mechanical Analysis (nanoDMA) in scanning mode.

Conclusion
Odontoblast apoptosis appears to start at the cell extension in dentinal tubules, proceeds from outer to inner dentin, and contributes to a change in the complex modulus and tan delta in old root dentin.