

Vertical root fracture (VRF) is one of the important causes of root canal treatment failure. The diagnosis of VRF can be difficult and it may occur many years after root canal treatment. In this thesis, the clinical and radiographic aspects of VRF, the factors associated with VRF and the time from root canal treatment to a diagnosis of VRF was investigated. This thesis also investigated the prevalence of microcracks in teeth without root canal treatment. The effect of root filling length on VRF and the effect of *in vivo* root canal instrumentation on the formation of radicular microcracks was also evaluated. The first part of this thesis concluded that the mean time period from root filling to the clinical presentation of VRFs in root canal treated teeth restored with crowns and without posts was 4.35 ( $\pm$  1.96) years. Posterior teeth, older patients (>40 years), female patients, and overfilled canals were found to be potential risk factors for VRF. The second part of this thesis has reported a 7.1% prevalence of radicular dentinal microcracks in teeth without root canal treatment, which were found more commonly in mandibular teeth and in older patients (>40 years). The third part of this thesis has indicated that root canal filling to or beyond the radiographic apex can be associated with VRF. The final part of this thesis concluded that the *in vivo* preparation of root canals with ProTaper hand or ProTaper rotary instruments did not result in the formation of root dentinal microcracks.