clinics and practice

MDPI

Article

Accuracy of Three Types of Apex Locators versus Digital Periapical Radiography for Working Length Determination in Maxillary Premolars: An In Vitro Study

Masoumeh Ramezani [1], Marjan Bolbolian [1,*], Mohaddeseh Aliakbari [2], Ahad Alizadeh [3], Maryam Tofangchiha [4,*], Seyed Mohammad Faegh [5], Romeo Patini [6,†] and Giuseppe D'Amato [7,†]

1 Department of Endodontics, Dental Caries Prevention Research Center, Qazvin University of Medical Sciences, Qazvin 34199-15315, Iran
2 Student Research Committee, Qazvin University of Medical Sciences, Qazvin 34199-15315, Iran
3 Medical Microbiology Research Center, Qazvin University of Medical Sciences, Qazvin 34199-15315, Iran
4 Department of Oral and Maxillofacial Radiology, Dental Caries Prevention Research Center, Qazvin University of Medical Sciences, Qazvin 34199-15315, Iran
5 Faculty of Stomatology, China Medical University, Shenyang 110001, China
6 Department of Head, Neck and Sense Organs, School of Dentistry, Catholic University of Sacred Heart, 00135 Rome, Italy
7 Unicamillus, International University of Health and Medical Sciences, 00131 Rome, Italy
* Correspondence: marjan.bolbolian@yahoo.com (M.B.); mt_tofangchiha@yahoo.com (M.T.)
† These authors contributed equally to this work.

Abstract: This study aimed to compare the accuracy of three types of apex locators versus digital radiography for working length (WL) determination. This experimental study was conducted on 58 extracted maxillary premolars. The teeth were decoronated, the access cavity was prepared, and WL was determined using a #15 K-file to serve as reference. The WL was then measured by Woodpex V, Woodpex III, and Root ZX apex locators in the presence of 0.9% saline, and also on a photostimulable phosphor plate (PSP) digital radiograph taken by the parallel technique. The values were compared with the actual WL using the paired *t*-test (alpha = 0.05). Digital radiography, Root ZX, Woodpex V, and Woodpex III determined the WL within ±0.5 mm from the actual value in 84.48%, 100%, 89.66%, and 87.93% of the cases, respectively. Woodpex V ($p = 0.039$), Woodpex III ($p = 0.001$), and Root ZX ($p = 0.001$) significantly over-estimated the WL. The WL measured on digital radiographs was not significantly different from the actual WL ($p = 0.213$). The position of the apical foramen (central/lateral) had no significant effect on the accuracy of WL determination by different techniques ($p > 0.05$). Within the limitations of this in vitro study, all the tested modalities showed acceptable accuracy for WL determination in maxillary premolars.

Keywords: apex locator; digital radiography; working length

check for updates

Citation: Ramezani, M.; Bolbolian, M.; Aliakbari, M.; Alizadeh, A.; Tofangchiha, M.; Faegh, S.M.; Patini, R.; D'Amato, G. Accuracy of Three Types of Apex Locators versus Digital Periapical Radiography for Working Length Determination in Maxillary Premolars: An In Vitro Study. *Clin. Pract.* **2022**, *12*, 1043–1053. https://doi.org/10.3390/clinpract12060107

Academic Editor: Gururaj Arakeri

Received: 23 November 2022
Accepted: 8 December 2022
Published: 12 December 2022

Publisher's Note: MDPI stays neutral with regard to jurisdictional claims in published maps and institutional affiliations.

1. Introduction

Precise cleaning of the root canal system and elimination of colonized microorganisms is the first step and a major goal in root canal therapy [1,2]. However, sterilization of the root canal system is not possible due to limitations of root canal disinfection techniques, instruments, and irrigants. Thus, cleaning of the root canal system is performed with the aim to decrease the intracanal microbial load in order not to interfere with periapical tissue healing [2,3]. Incorrect determination of working length (WL) can lead to complications such as postoperative pain and discomfort, the need for retreatment, and even tooth extraction. Thus, correct determination of WL is an imperative prerequisite for a successful endodontic treatment [4].

Several techniques and instruments are available for WL determination, such as the use of tactile sense, radiography, and apex locators [4]. Radiography is currently the most