Effect of Blood Contamination on Some Properties of a Tricalcium Silicate Based Root End Filling Material

(In Vitro Study)

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بسم الله الرحمن الرحيم

{قالُوا سُبْحَانَكَ لَا عِلْمَ لَنَا إِلَّا مَا عَلَّمْتَنَا إِنَّكَ أَنتَ الْعَلِيمُ الْحَكِيمُ}

(سورة البقرة: الآية ٣٢)

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All praise be to ALLAH the most gracious ,the most merciful

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Dedication

This work is dedicated to….

The soul of my beloved mother who had always been a major source of love and support throughout my whole life. She is deeply missed in every moment. May her beautiful soul rest in peace.

My beloved father, brother and sister who have been a constant source of emotional and moral support in every aspect of life.

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List of contents

- **Introduction……..1**
- **Review of literature……..3**
- **Aim of study……38**
- **Materials and methods……..39**
- **Results…….59**
- **Discussion……81**
- **Summary and conclusion……..91**
- **References……...94**

List of tables

- **Table 1: Materials, instruments and devices used in the study.....39**
- **Table 2: Showing push-out bond strength values, mean and standard deviation values for intergroup comparison between blood contaminated and non-contaminated samples 62**
- **Table 3 below showing values of Ca/P ratios calculated from each sample of both groups, their mean and standard deviation at day 1, 7 and 30 .....78**
- **Table 4 below showing mean and standard deviation values of the calculated Ca/P ratios at day 1, 7 and 30 for intergroup comparison between blood-contaminated and non-contaminated samples and for intra-group comparison of the effect of time within each group 79**

List of figures

- **Figure 1: Septodont Biodentine 41**
- **Figure 2: Hanks' Balanced Salt Solution 41**
- **Figure 3: Side view of resected root showing the resection angle perpendicular to the long axis of the root.....44**
- **Figure 4: The diamond coated ultrasonic retrograde tip used for retrograde cavity preparation 44**
- **Figure 5: Top view of resected root showing the prepared retrograde cavity.....45**
- **Figure 6 A diagram showing sample classification.....46**
- **Figure 7: The Biodentine capsule holder.....48**
- **Figure 8: The teeth with prepared and filled retro-cavities inserted into Eppendorf tubes containing either blood or deionized water 48**
- **Figure 9: A dentin disc with set Biodentine in its center.....49**
- **Figure 10: Universal testing machine for push-out bond strength evaluation.....51**
- **Figure 11: Dentine disc with attachment (above disc) dislodging the Biodentine filling (below disc) from its center 52**
- **Figure 12: Dentin discs with dislodged Biodentine filling 52**
- **Figure 13: SEM and EDX analysis unit 57**

- **Figure 14: photograph showing the fractured dentin disc and the set Biodentine filling removed from its center 57**
- **Figure 15: A) Low magnification SEM image showing set Biodentine and surrounding radicular dentine. B) High magnification SEM image showing Biodentine-dentin interface. 58**
- **Figure 16: SEM image showing the 3 areas chosen for EDX analysis.....58**
- **Figure 17: Elemental analysis showing the different percentages of each element in a single area examined by EDXA.....59**
- **Figure 18: Bar chart showing mean and standard deviation values for intergroup comparison of blood contaminated and non-contaminated samples 63**
- **Figure 19: Low and high magnification SEM images of a specimen from non-contaminated control group (I-B) at day 1 .....66**
- **Figure 20: Low and high magnification SEM images of a specimen from non-contaminated control group (I-B) at day 7 .....67**

- **Figure 21: Low and high magnification SEM images of a specimen from non-contaminated control group (I-B) at day 30.....68**
- **Figure 22: Low and high magnification SEM images of a specimen from blood-contaminated group (II-B) at day 1....69**
- **Figure 23: Low and high magnification SEM images of a specimen from blood-contaminated group (II-B) at day 7....70**
- **Figure 24: Low and high magnification SEM images of a specimen from blood-contaminated group (II-B) at day 30..71**
- **Figure 25: SEM images taken after 1 day immersion in HBSS and analyzed by Image J software. A) Non-contaminated control sample (I-B) showing 34.27% of surface covered by deposits. B) Blood-contaminated sample (II-B) showing 12.16% of surface covered by deposits. 72**
- **Figure 26: SEM images taken after 7 days immersion in HBSS and analyzed by Image J software. A) Non-contaminated control sample (I-B) showing 58.67% of surface covered by deposits. B) Blood-contaminated sample (II-B) showing 21.93% of surface covered by deposits. 73**
- **Figure 27: SEM images taken after 30 days immersion in HBSS and analyzed by Image J software. A) Non-contaminated control sample (I-B) showing 61.48% of surface covered by**

deposits. B) Blood-contaminated sample (II-B) showing 23.01% of surface covered by deposits. 74

- **Figure 28: EDX graphs produced from analysis of 3 randomly selected points from the Biodentine-dentin interface. 77**
- **Figure 29 Bar chart showing mean and standard deviation values of the calculated Ca/P ratios at day 1,7 and 30 for intergroup comparison between blood-contaminated and non-contaminated samples. 80**
- **Figure 30 showing mean values of Ca/P ratio calculated for blood-contaminated and non-contaminated control samples at day 1, 7 and 30 for comparison with the Ca/P ratio of normal stoichiometric hydroxyapatite. 80**
- **Figure 31 image showing XRD analysis of Biodentine powder obtained from the non-contaminated control group (I-B)....82**
- **Figure 32 image showing XRD analysis of Biodentine powder obtained from the blood-contaminated group (II-B). 82**

List of abbreviations

Abbreviation	Full term
• **ACP**	Amorphous calcium phosphate
• **C-S-H**	Calcium silicate hydrate
• **EDX**	Energy dispersive X-ray
• **EDXA**	Energy dispersive X-ray analysis
• **ESEM**	Environmental scanning electron microscopy
• **FT-IR**	Fourier transform infrared spectroscopy
• **HA**	Hydroxyapatite
• **HBSS**	Hank's balanced salt solution
• **MTA**	Mineral trioxide aggregate
• **SBF**	Simulated body fluid
• **SD**	Standard deviation
• **SEM**	scanning electron microscope
• **STF**	Simulated tissue fluid
• **XRD**	X-ray diffractometer

Endodontic surgery is sometimes indicated when non-surgical treatment modalities or retreatment are proved to be unsuccessful or if they are contraindicated to begin with. The procedure generally consists of exposing the apical diseased area, resection of the root end, retrograde cavity preparation and insertion of a root end filling material [(1)].

Several materials have been proposed as root end filling materials. According to Gartner and Dorn [(2)], a material used to seal the root-end cavities is considered to be ideal if it is able to prevent microorganisms and their byproducts from leaking into the periapical tissues. The material has to be non-carcinogenic, non-toxic, dimensionally stable and biocompatible with tissue fluids as well. Its sealing ability should not be affected by the presence of 0moisture. For clinical application, it should be simple to use as well as having an adequate degree of radio-opacity to be recognized in the radiograph [(3)].

Bioceramics [(4)], which are specially designed ceramics used for replacement of body parts that are lost or diseased, were proposed as a very promising material to be used in retrograde cavities [(1)]. The first generation of bioceramics used in endodontics was MTA [(5)]. It is a tri-calcium silicate based cement which

explains its sealing ability and biocompatibility. However, it suffered a number of drawbacks such as long setting time and difficult handling properties allowing new materials to be developed claiming the ability to overcome these flaws.

Biodentine (Septodont, France), is a pure tricalcium silicate based cement that was marketed as dentin substitute. Several investigations have previously reported its successful use for retrograde filling [(6)], root perforation repair [(7)], pulp capping [(8)], apexification [(9)] and treatment of resorptions[(10)].

During clinical application, exposure of root end filling material to blood might affect its setting reaction. This might negatively affect the biological and physical properties of the material.

Therefore, conducting a study to evaluate the effect of blood contamination on Biodentine when used as a retro-filling material was thought to be of value.

The null hypothesis is that the properties of Biodentine will not be affected by blood contamination.

I. Definition of Bioceramics, Biocompatibility and Bioactivity:

Bioceramics were defined by **Raghavendra et al** [11] as materials containing bioactive glass, alumina, zirconia, , glass ceramics, hydroxyapatite as well as other elements. They have been successfully used for filling up bony defects, formation of apical plugs, root repair, retro-filling, filling of perforations, for regenerative purposes as well as endodontic sealers. They have exceptional properties such as biocompatibility, dimensional stability and bio-inertness. They have a similarity to hydroxyapatite, and most importantly an intrinsic osteo-conductive activity thus inducing regenerative responses in the human body.

Gandolfi et al [12] defined biocompatibility of a Bioceramic material as its ability to support cell growth and attachment as well as cell-surface interaction.

Kokubo et al [13] described bioactivity as the ability to form a chemical bond with the living tissues, a prerequisite for that bonding is the ability to form a bone-like apatite layer.

Chen et al [14] also described bioactivity as the ability of the material to interact with the surrounding tissue fluids forming apatite like deposits