

**Assessment of Antibacterial Activity, Cytotoxicity and  
Penetration Ability of Novel Nanobased Endodontic  
Irrigating Solutions (An In-vitro Study)**

Thesis

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بسم الله الرحمن الرحيم

قَالُوا سُبْحَانَكَ لَا عِلْمَ لَنَا إِلَّا مَا عَلَّمْتَنَا إِنَّكَ أَنْتَ الْعَلِيمُ الْحَكِيمُ

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## **List of abbreviations**

	<b>Page</b>
<b>Introduction.....</b>	<b>1</b>
<b>Review of Literature:</b>	
• <b>History of nanotechnology in medical field .....</b>	<b>3</b>
• <b>Bacterial elimination and root canal disinfection.....</b>	<b>7</b>
• <b>Silver Nanoparticles .....</b>	<b>12</b>
• <b>Zinc oxide nanoparticles.....</b>	<b>27</b>
<b>Aim of the study .....</b>	<b>36</b>
<b>Materials ad Methods.....</b>	<b>37</b>
<b>Results.....</b>	<b>59</b>
<b>Discussion.....</b>	<b>90</b>
<b>Summary and Conclusion .....</b>	<b>103</b>
<b>References.....</b>	<b>106</b>
<b>Arabic Summary</b>	

## **List of Tables**

<b>Table</b>	<b>Page</b>
<b>1</b> Mean and SD for the Log 10 (CFU/ml) for Ag Nps.....	<b>61</b>
<b>2</b> Mean and SD for the Log 10 (CFU/ml) for ZnO Nps.....	<b>63</b>
<b>3</b> Mean and SD for the Log 10 (CFU/ml) for NaOCl.....	<b>65</b>
<b>4</b> Mean and SD for the Log 10 (CFU/ml) for different materials.....	<b>68</b>
<b>5</b> Mean and SD for the viability % for Ag Nps.....	<b>69</b>
<b>6</b> Mean and SD for the viability % for ZnO Nps.....	<b>71</b>
<b>7</b> Mean and SD for the viability % for NaOCl .....	<b>72</b>
<b>8</b> Mean and SD for the viability % with different materials....	<b>75</b>
<b>9</b> Mean and SD for the depth of penetration ( $\mu\text{m}$ ) for different particle sizes for Ag Np.....	<b>79</b>

<b>Table</b>	<b>Page</b>
<b>10</b> Mean and SD for the depth of penetration ( $\mu\text{m}$ ) of different particle sizes for ZnO Np.....	<b>82</b>
<b>11</b> Mean and SD for the depth of penetration ( $\mu\text{m}$ ) of NaOCl...	<b>84</b>
<b>12</b> Mean and SD for the depth of penetration ( $\mu\text{m}$ ) of different tested groups .....	<b>88</b>



## **List of Figures**

<b>Figure</b>	<b>Page</b>
<b>1</b> Glass tubes filled with sterile BHI.....	<b>40</b>
<b>2</b> Sample grouping.....	<b>43</b>
<b>3</b> Micropipette.....	<b>46</b>
<b>4</b> BHI agar plate.....	<b>46</b>
<b>5</b> Cell culture medium.....	<b>50</b>
<b>6</b> The microtiter plates.....	<b>50</b>
<b>7</b> Sample grouping .....	<b>55</b>
<b>8</b> One root split longitudinally .....	<b>57</b>
<b>9</b> SEM photograph for the depth of penetration of dentinal tubules.....	<b>57</b>
<b>10</b> Bar chart showing the mean Log 10 (CFU/ml) for Ag Nps.....	<b>61</b>
<b>11</b> Bar chart showing the mean Log 10 (CFU/ml) for Zn Np.....	<b>63</b>
<b>12</b> Bar chart showing the mean Log 10 (CFU/ml) for NaOCl.....	<b>65</b>
<b>13</b> Bar chart showing the mean Log 10 (CFU/ml) for different tested materials.....	<b>68</b>
<b>14</b> Bar chart showing the mean viability % for Ag Nps.....	<b>70</b>

<b>Figure</b>	<b>Page</b>
<b>15</b> Bar chart showing the mean viability % for ZnO Nps.....	<b>71</b>
<b>16</b> Bar chart showing the mean viability % for NaOCl.....	<b>73</b>
<b>17</b> Bar chart showing the mean viability % for different tested materials.....	<b>76</b>
<b>18</b> TEM micrographs. CH= Chromatin, V= vacuoles , Arrow= discontinuity of cell membrane.....	<b>78</b>
<b>19</b> Bar chart showing the mean depth of penetration ( $\mu\text{m}$ ) for different particle sizes of Ag Nps.....	<b>80</b>
<b>20</b> SEM photomicrographs: (A) Coronal third of Ag 75nm , (B) Middle third of Ag 75, (C) Apical third of Ag 75nm.....	<b>81</b>
<b>21</b> SEM photomicrographs: (A) Coronal third of Ag 25nm , (B) Middle third of Ag 25 nm, (C) Apical third of Ag 25 nm.....	<b>81</b>
<b>22</b> Bar chart showing the mean depth of penetration ( $\mu\text{m}$ ) for different particle sizes for ZnO Np.....	<b>83</b>

<b>Figure</b>	<b>Page</b>
<b>23</b> SEM photomicrographs: (A) Coronal third of ZnO 75 nm , (B) Middle third of ZnO 75nm , (C) Apical third of ZnO 75 nm.....	<b>84</b>
<b>24</b> SEM photomicrographs: (A) Coronal third of ZnO 25 nm , (B) Middle third of ZnO 25nm , (C) Apical third of ZnO 25 nm.....	<b>84</b>
<b>25</b> Bar chart showing the mean depth of penetration ( $\mu\text{m}$ ) for NaOCl.....	<b>86</b>
<b>26</b> SEM photomicrographs: (A) Coronal third of Ag 25nm , (B) Middle third of Ag 25, (C) Apical third of Ag 25.....	<b>86</b>
<b>27</b> Bar chart showing the mean depth of penetration ( $\mu\text{m}$ ) for different tested group .....	<b>89</b>

# ***INTRODUCTION***

Elimination of microorganisms from the root canal system plays an important role in achieving a long term success in endodontic treatment <sup>(1)</sup>. Despite the advances in the tools and techniques that are used in endodontic treatment, the success rate of the treatment is still a problem. Colonization of various kinds of bacteria in biofilm, formation of smear layer during instrumentation, complex anatomy of root canal system and the remaining microorganisms in dentinal tubules are the main causes of failure and reinfection in endodontic treatment<sup>(2)</sup>.

Many irrigation solutions have been developed to improve and complement the mechanical debridement procedure. Canal irrigation solutions should possess characteristics such as low toxicity, low surface tension, lubrication, long-lasting antimicrobial effect, easy availability, tolerable odor, and reasonable cost. Chlorhexidine, sodium hypochlorite, EDTA, MTAD or tetracycline isomer, phenol and alcohol derivatives, iodide potassium iodine and formocresol are among the commonly used root canal irrigation solutions <sup>(3)</sup>.

Sodium hypochlorite has a wide range of antimicrobial activity and is able to kill various bacteria. It also has disadvantages such as toxicity and risk of tissue destruction, bad taste, inability to eliminate all the microorganisms present in infectious canals and risk of physically changing the structure of dentinal canal walls<sup>(4)</sup>.

Introduction of nanobased materials has brought new abilities into different scientific fields. An important group of nanomaterials for biological applications are nanobased antimicrobial agents. This group of nanobased materials benefits from new mechanisms for efficient disinfection and microbial control.

Various nanoparticles have gained popularity as antimicrobial agents as a result of their broad spectrum of activity and biocompatibility. Nanoparticles exhibit higher antibacterial activity as a result of their polycationic/ polyanionic nature with higher surface area and charge density, resulting in greater degree of interaction with bacterial cell.

Silver nanoparticles along with antibacterial effect, also exhibit novel physicochemical and biological activities <sup>(5)</sup>. Zinc oxide nanoparticles have also been shown to possess good antibacterial property. They have bacterial effects on both gram-positive and gram-negative bacteria. They even have antibacterial activity against spores which are resistant to high temperature and pressure.

Based on that it was thought that evaluation and comparing a new irrigation solution containing nanosilver and nanozinc-oxide particles with sodium hypochlorite was of great value.

## ***REVIEW OF LITERATURE***