The Cytotoxic And Genotoxic Effects Of Nickel Titanium And Stainless Steel Wires On Buccal Mucosa Cells Of Orthodontic Patients. (An In -Vivo Study)

A THESIS
Submitted to the Faculty of
Oral and Dental Medicine, Cairo University
in partial fulfillment of the requirements for the
Doctor's Degree in Orthodontics.

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2009

بِسۡمِ ٱللَّهِ ٱلرَّحۡمَٰنِ ٱلرَّحِيمِ

{ ... ولا يحيطُونَ بِشيءٍ من علْمه إلا بِما شاء وسع كُرسيه

السماوات والأرض ولا يؤوده حفْظُهما وهو الْعلي الْعظيم}

صدق الله العظيم

سورة البقرة الايه 255

{ …And they will never compass anything of His Knowledge except that which He wills. His Kursi extends over the heavens and the earth, and He feels no fatigue in guarding and preserving them. And He is the Most High, the Most Great.}

[Verse 2:255]

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DEDICATION

With all humbleness and gratitude,

I dedicate this work to my supportive and loving family.

ACKNOWLEDGEMENT

My heart felt gratitude goes to my teachers, ***Professor Dr. Faten Eid***, ***Professor Dr. Essam Nassef*** and ***Assisitant Professor Dr. Wael Attia*** for their patience, continuous support, invaluable advice and constructive critisim. I deeply thank them for all they have taught me and for teaching me the true value of research work.

I would also like to thank ***Professor Dr. Emad Al-Ashkar***, ***Head of Spectroscopy Department, Physics Division, National Research Center*** for taking interest in this reasearch and personally performing and analyzing the Atomic Absorption Spectrometry. He is a great teacher and I thank him for the time he took to explain the various procedures of the technique.

I thank ***Professor Dr. Adel Sayed Amin, Head of the Biotechnology Research Unit, Reproduction Research Institute*** and all the unit's staff for their help and kindness in allowing me to freely use their facilities. Special thanks go to ***Dr. Eman Abd El Fattah***, ***Assistant researcher***, for devoting many of her resting hours in teaching and helping me till I was able to perform the Comet Assay. I would also like to thank the staff of the ***Pathology Department***, ***Reproduction Research Institute*** for providing the epiflurescent microscope for the visualization of the Comet Assay.

I would also like to thank ***Professor Dr. Sherief Nassih, Professor of Clinical Pathology, Faculty of Medicine, Cairo University,*** for his technical advice on the sampling procedures and ***Professor Dr. Andrew Collins, Professor of Nutrition, Department of Nutrition, University of Oslo, Norway*** and ***Dr***. ***Yim Tong Szeto***, ***Clinical Lab Manager, Applied Research in Medicine and Health, Macau University of Science and***

Technology Foundation, China for their technical advice on the specifics of the Comet Assay.

Warm thanks are also extended to ***Dr. Salah Mahdy***, ***Lecturer of Applied Statistics, Institute of Statistical Studies and Research*** for having made the time and effort for a meticulous statistical analysis and ***Professor Dr. Amal Ahmed El Badawy, Department of Public Health, Faculty of Medicine, Zagazig University*** for her guidance and help in the biostatistical analysis.

Personal thanks are extended to all the subjects who participated in this study, many of them being my friends and their families. I thank them for their generosity and time.

Last but foremost, I would like to thank all my ***Professors at the Orthodontic Department, Cairo University*** for all they have taught me, for being helpful and most of all for being supportive.

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INTRODUCTION

Within the dental field, a large array of materials is used intraorally. These range from polymers, ceramics to pure metals and the more commonly used metal alloys. Metal alloys are the base of most fixed and removable prosthetics, metallic restorations, surgical implants and orthodontic appliances.

In orthodontics, the most commonly used metal alloys include Stainless Steel in its austenitic form, in a configuration of 18% chromium and 8% nickel. Fixed orthodontic appliances use Stainless Steel for bands and brackets. It is also used in orthodontic archwires applied in early and late stages of treatment. Nickel titanium (approximately 50% nickel and 50% titanium) is another material used for orthodontic archwires. It has gained wide acceptance with the introduction of the straight wire appliance and is also used in initial stages of treatment due to its high spring back and wide range of action.

In view of orthodontic appliances, due to their direct contact with the oral tissue, their possible penetration of the tissues and the prolonged nature of the orthodontic treatment, special consideration must be given to the safety and biocompatibility of these materials.

A point of consideration upon evaluating the biocompatibility of orthodontic metal alloys is biodegradation. The biocompatibility is inpart an interaction between the material and its surroundings. The oral cavity has always been considered an optimum corrosive cell. The presence of enzymes, bacteria, fluctuating pH and temperature, along with the saliva acting as an electrolytic solution, enhances biodegradation. Corrosion is also encouraged due to the inherent heterogeneity of the metal alloys, micro-surface discontinuity and forces acting on the appliances especially the stresses of the orthodontic wires and the friction between the wires and brackets. All of these

factors enhance the biodegradation of orthodontic metal alloys, providing free metal ions that may affect the oral tissues.

It has been documented that some orthodontic appliances have caused contact dermatitis, hypersensitivity and anaphylactoid reactions. The most commonly implicated materials were nickel, chromium and cobalt, which are considered immunologic sensitizers. Although these reactions are not consistent with biocompatibility, they are controlled by the removal of the causative alloy and replacing the used material. The true question is: Are these materials causing cytotoxic or genotoxic effects on the human tissue and in turn affecting the cells' functions or their repair capacity?

No frank concern has been raised regarding orthodontic alloys, yet the literature on cancer research and metal toxicology is rich with reports of the dangers posed by various metal ions. Also the recent insight into the cellular and molecular mechanisms of metal toxicity indicate that prolonged availability of subtoxic concentrations of metal ions have altered cellular metabolism and morphology and produced DNA instability.

Few studies in the orthodontic literature report biological toxicity in orthodontic patients, so the fact that most research on the amount of released metal ions from orthodontic alloys fall below the recommended daily dietary intake of metals may be a false assurance of safety.

The question of how safe orthodontic appliances are, is still to be answered since few studies have tested their effect in their true functional environment.

This study will attempt to evaluate the effects of orthodontic appliances in the oral cavity during regular orthodontic treatment.