CORRELATION AND INITIATION OF NICKEL SENSITIVITY DUE TO TRAUMA DURING ORTHODONTIC TREATMENT

By

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A THESIS PRESENTED TO THE GRADUATE SCHOOL
OF THE UNIVERSITY OF FLORIDA IN PARTIAL FULFILLMENT
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I would like to express my gratitude to my wife, Lorie, who has supported me in all my endeavors. To my mother and father, I am grateful for the sacrifices they have made throughout the years.

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The purpose of this study was to determine the susceptibility of nickel sensitization caused by nickel exposure via trauma from orthodontic appliances during orthodontic treatment. A prospective, longitudinal study involving 30 orthodontic patients used nickel patch tests to test for sensitivity and monthly diaries to record trauma. Subjects were recruited from the University of Florida Graduate Orthodontic clinic. Eight patients failed to continue with the study, leaving a sample of 22 individuals. Baseline nickel patch test were performed prior to and 6 months after orthodontic treatment initiation. Trauma was recorded by each participant using a diary. Appliances utilized were recorded at each regularly scheduled patient visit. Nickel patch results and trauma were analyzed to see if a correlation existed.

The results showed that the sample undergoing six month patch testing was too small to gain conclusive data on allergy incidence. Trauma, especially ulcerations, was seen to decrease through the first three appointments, yet increased during the interval between the third and fourth visit. Significance was seen for the decrease in ulcerations between visits 1 and 2 (P=0.02); lacerations showed a significant increase between visits 3 and 4 (P=0.03). No

conclusions were possible in correlating nickel sensitivity and orthodontic trauma due to a small sample size. However, trauma is influenced by the stage of treatment due to the shape and dimension of the archwires utilized for certain mechanics.

CHAPTER 1
INTRODUCTION

Nickel is second only to poison ivy/poison oak as the most common cause of allergic contact dermatitis and ranked first in frequency of positive patch test reaction.[1] Oral manifestations of nickel sensitivity include mucosal erythema with or without edema, contact stomatitis, or lip swelling with a perioral rash.[2] Eczematous dermatitis or hives/urticaria is characteristic of the systemic signs for the allergic response.[3]

Estimated to be found in 14–20% of women and 2–4% of men within the United States, nickel dermatitis is a cell-mediated, delayed, type IV hypersensitivity reaction that is a response to the antigen nickel; it is a form of allergic contact dermatitis.[4] Once thought of as an "occupationally-required" allergy, nickel sensitivity has become a "consumer-related" phenomenon correlating to rising contemporary trends and styles in piercings among both females and males.

In regard to ear piercing and nickel sensitivity, studies have found a correlation between the two factors. Dotterud and Falk[5] found that 30.8% of Norwegian girls with their ears pierced were nickel sensitive, compared to only 16.5 % of those without pierced ears. Similar results were found by Larsson-Stymne and Widstrom;[6] among girls with pierced ears, the frequency of girls sensitive to nickel was found to be 13% and 1% in those without pierced ears. With changing fashion trends, increasing numbers of males have begun to pierce their ears over the years. In the study of Norwegian school children, Dotterud and Falk[5] found that boys with pierced ears had a higher rate of nickel sensitivity than boys without pierced ears.

Ear piercing and orthodontic treatment are similar in the fact that they both expose alloys to a moist and corrosive environment, therefore, increasing the chance of nickel sensitization.

Prior to 1970, orthodontic therapy was conducted mainly with the metals gold and stainless steel. Nickel-titanium (NiTi) was introduced to the field of orthodontics in 1971. NiTi alloys can contain as much as 55 % nickel, compared to the 8% found in conventional stainless steel.[7] Nickel titanium's properties of elasticity and shape memory make it an ideal alloy for orthodontic tooth movement. It allows for a constant force to be applied over an extended period of time.[8] With improved technology, the field of orthodontics has been able to take advantage of the different physical properties and phases (martensite and austenite) of copper Niti (CuNiti); the wire has all the properties of nickel titanium, but with even more elasticity and less nickel composition. CuNiti archwires can contain up to 50% nickel; the amount of nickel is less than contemporary Niti wires, yet still significantly more than traditional stainless steel.

Corrosion of orthodontic alloys has raised concern due to the significance of metal ion exposure. Fixed orthodontic appliances release a measurable amount of nickel when placed in the oral cavity.[9, 10] Agaoglu et al.[9] found that nickel saliva levels were the highest at the 1 month treatment time in comparison with start of treatment, 1 week, 1 year, and 2 years into orthodontics treatment with full appliances. The high nickel release in saliva at the 1 month period may be due to usage of high nickel content archwires at the beginning of treatment to level and align.

Previous studies have shown that an increased number of piercings or perforations correlated to an increased frequency of sensitivity to nickel.[5, 11] Ehrlich et al.[11] concluded that the number of body piercings has a positive bearing on the incidence of metal/nickel allergy in men. Four percent of the unpierced sample was found to be metal sensitive compared to 11.1% and 14.6% in the single and multiple pierced samples. With more piercings, the amount of exposure to a moist and corrosive environment is increased. In relation to orthodontic treatment,

nickel appliances are always exposed to a moist and corrosive environment when in the oral cavity.

Orthodontic treatment is a dynamic process that relies on the body's ability to adapt to the appliances utilized. As orthodontic brackets and wires are introduced within the oral cavity, mucosal irritation and lacerations may appear. When the patient's body reacts adversely to the appliance compositions, a number of factors can be affected: treatment time and efficiency, treatment satisfaction, general health and quality of life. Patients who seek orthodontic care desire comfortable care, short treatment times, and esthetic results. Practitioners can provide optimum treatment by utilizing the "state of the art" technologies available. The introduction of NiTi has aided orthodontists in achieving patients' desired outcomes. Even so, with increased exposure to vascular molecules and the immune system, trauma caused by nickel may trigger a hypersensitivity response. In theory, with trauma or injury inflicted during orthodontic treatment nickel sensitization may occur.

The objective of this study was to determine the susceptibility of nickel sensitization caused by nickel exposure from orthodontic appliances during orthodontic treatment.

CHAPTER 2
MATERIALS AND METHODS

Experimental Design

A prospective, longitudinal study involving a desired recruitment goal of 100 patients from the University of Florida Graduate orthodontic clinic was completed utilizing a daily diary to record incidence of trauma during treatment with fixed appliances. Patients accepted into the study were required to be at least 12 years of age, in good general health, have no previous history of orthodontic treatment with fixed appliances, and treatment planned for orthodontic treatment in at least one dental arch for a minimum period of 6 months with orthodontic arch wires and brackets/bands. Participants received comprehensive orthodontic treatment based on examination and need assessment from supervising clinical faculty. The study was approved by the Institutional Review Board, and participants completed a written informed consent.

Of the 30 patients recruited, 22 patients continued to participate in the study; 8 patients either declined orthodontic treatment or failed to partake in the evaluation for initial nickel sensitivity prior to treatment. 59.1% (13) of the subjects were female; the male sample was 40.1% (9) of the total. Table 2-1 shows statistics of age.

Table 2-1. Age

Median	Mean	Minimum	Maximum
15.8	18.8	11.9	64.1

Each patient was asked to complete a questionnaire to obtain demographic information and assess general health (Appendix A). To account for previous systemic nickel exposure, piercing and age at piercing were noted.

Nickel patch tests were administered to assess the initial nickel sensitivity level of each subject prior to orthodontic treatment. Two 8mm Finn chambers® on Scanpor, a hypoallergenic surgical tape, were filled with either a 5% nickel sulfate suspension or a white petrolatum control

medium; each Finn chamber® was filled slightly greater than 50%, according to manufacturer's recommendations (approximately 4mm). The patches were placed on the patients' non-dominant forearm for a period of 48 hours. Patients were instructed to avoid moisture around the patch site and not to remove the patch unless a burning sensation was experienced or an extreme itching sensation occurred. After 48 hours, the subjects returned to have an assessment of the patch site. The allergen and control sites were examined by an orthodontic resident at the time of patient presentation. Patch sites were photographed to be reexamined by a trained oral pathologist. Scoring for the test sites were defined as follows:

1. (0) negative reaction
2. (1) weak (nonvascular) positive reaction: erythema, infiltration, possible papules
3. (2) strong (vascular) positive reaction: erythema, infiltration, papules, vesicles
4. (3) extreme positive reaction: bullous.

If a strong (2) or extreme (3) reaction was recorded, the patient was not allowed to continue with the study; one subject did present with a strong positive reaction. After fixed appliance bonding, patch tests were re-administered after the sixth regularly scheduled orthodontic appointment.

The fixed appliances utilized varied according to faculty preference and availability in the graduate orthodontic clinic. Appliances and archwires were recorded for six regularly scheduled orthodontic appointments on the orthodontic maintenance form (Appendix B). The bands, brackets, archwires, and their compositions are listed in Table 2-2. The maintenance form was completed by an orthodontic resident after each appointment; its components recorded four areas: (1) nickel patch test results prior to treatment and after six appointments with fixed appliances; (2) appliances worn; (3) emergency visits; and (4) iatrogenic trauma during appliance placement. Emergency visits and the specific reason for the visit were recorded because of the possible trauma associated with the event.

A daily diary form (Appendix C) was used to record intra-oral trauma experienced by the patients. Trauma was explained to patients as an ulceration or laceration to the oral tissues. The diary consisted of three sections: (1) new piercings and their locations during the observation period; (2) utilization of wax to minimize discomfort experienced from lacerations or ulceration; and (3) trauma experienced, along with time of experience in days. New piercings were recorded to account for additional systemic nickel introduction. Upon orthodontic appointment, the treating orthodontic resident noted any trauma that may not have been reported by the patient. Diaries were initially given to the participants on the day of appliance bonding; patients were instructed to return the completed diaries at subsequent appointments, at which point they received a new form. Diaries were completed for six consecutive regular appointments.

Statistical Analysis

Descriptive data was determined for nickel allergy patch test results, trauma recorded by diaries, and archwire changes. The study sample was analyzed by Wilcoxon signed rank tests to assess significance of traumatic occurrences between treatment/appointment interval, at $P < .05$.

Table 2-2. Band, bracket and wire nickel composition

Appliance	Manufacturer	Nickel Composition
Bands		
1. American	American Orthodontics	3–15%
2. GAC	GAC	8–10%
	3M	
3. 3M Unitek	Unitek	10%
Brackets		
1. American	American Orthodontics	3–45%
2. Damon®	Ormco	3–5%
3. In-Ovation R®	GAC	3–5%
Sliding clip:		10–20%
4. Mini-Ovation®	GAC	3–5%
	3M	
5. SmartClip®	Unitek	10%
6. Time 2®	American Orthodontics	3–45%
	3M	
7. Victory®	Unitek	9%
Wires		
1. BioForce®	GAC	50.40%
2. Damon®/Ormco CuNiTi	Ormco	49.10%
	3M	
3. Nitinol Classic®	Unitek	55%
	3M	
4. Nitinol HA®	Unitek	55%
5. Stainless steel	Ortho Technology	3.5–42.5%
6. Nickel titanium	Ortho Technology	55%
7. TMA	GAC/Ormco	0%

CHAPTER 3
RESULTS

Nickel Patch Tests

Baseline patch tests were placed in order to determine the initial sensitivity of each patient to nickel. Figure 3-1 illustrates the two positive findings; one was a weak reaction, while the other was a strong positive reaction. The strong patch result excluded the patient from continued participation within the study. Positive subjects consisted of one male and one female; 11.1% of males and 7.7% of females tested positively (Figure 3-2).

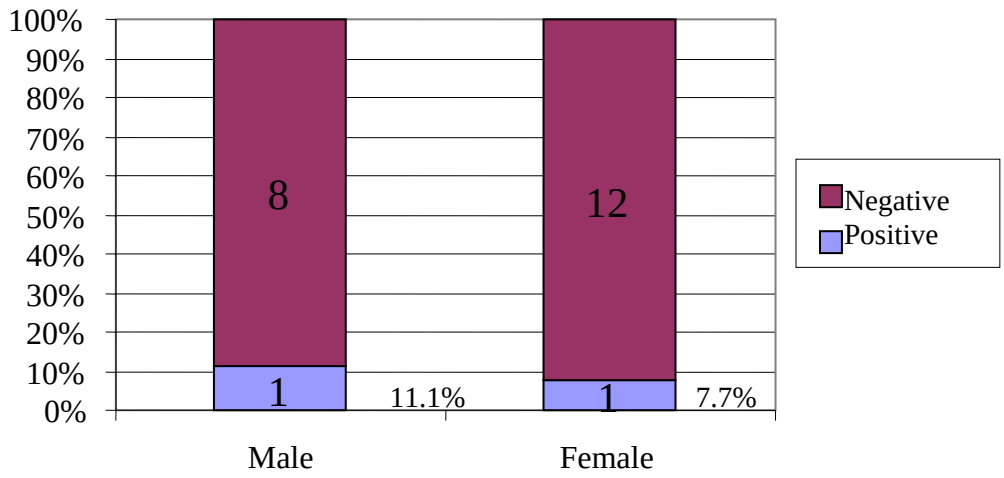

Figure 3-2. Sex differences for baseline nickel allergy patch results.

Nickel patch tests were again administered after six months or six regularly scheduled appointments with fixed orthodontic appliances. Only nine of the 22 initial patch subjects were eligible for re-test at the chosen time of assessment. Figure 3-1 shows that all six individuals had negative allergic responses.

Previous Nickel Exposure from Piercings

Pre-orthodontic, baseline, piercing data was recorded to take into consideration systemic nickel exposure prior to fixed appliance therapy. The unpierced subjects consisted of males only; 13 of the 16 pierced individuals were female. 100% of the females presented with piercings (Figure 3-3).

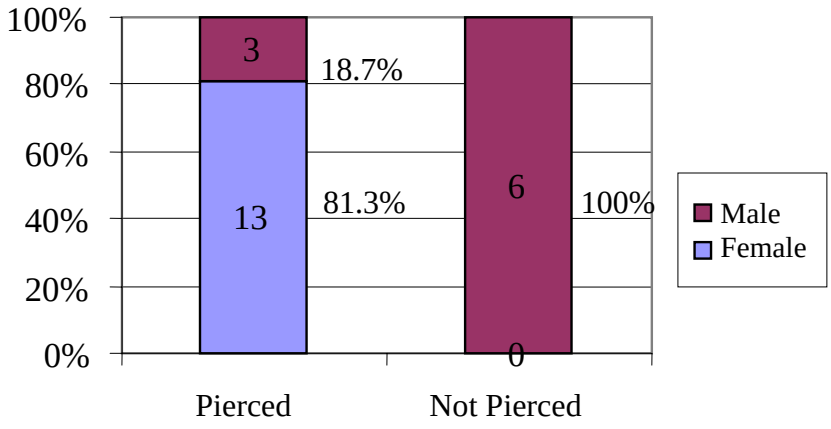

Figure 3-3. Descriptive data on baseline piercings of individuals.

Trauma

Patient diaries showed the number of lacerations and ulcerations experienced by patients during each appointment interval. Figure 3-4 represents the average trend for each type of trauma for the first four treatment intervals. Only the first four appointment periods were utilized due to the small number of subjects/diaries available for the latter appointments. Both, lacerations and ulcerations, tended to decrease with subsequent orthodontic treatment visits. When compared to lacerations (1.1 to 0.9), ulcerations appeared to decrease a greater degree from the first to the second appointment (2.5 to 0.8). Average trauma occurrences decreased at

the third visit, yet increased at the subsequent appointment. Total percentage of patients experiencing trauma showed the same trend (Table 3-1).

Wilcoxon signed rank tests were performed to see if any significant differences existed for traumatic occurrences between the appointment intervals (Tables 3-2 and 3-3). Subjects were included only if diaries were available for the two visits within the appointment interval. Visits after the fourth appointment were again not considered due to small sample size. Lacerations showed a significance from visit 3 to visit 4 at P=0.03; more cuts were experienced from the fourth visit than the third. The interval between visit 1 and visit 2 showed significance for ulcerations experienced at P=0.02; as mentioned previously, average ulceration decreased noticeably from the first to the second appointment.

Table 3-2. Wilcoxon signed rank test: lacerations between appointments

Appointment Interval	Sample	Mean	Median	SD	Range	P Value
Visit 1-2	13	0.15	0.00	1.68	7.00	0.63
Visit 2-3	11	0.91	0.00	1.64	6.00	0.13
Visit 3-4	10	-0.90	-1.00	0.88	2.00	0.03*

*Significance at P<0.05

Table 3-3. Wilcoxon signed rank rest: ulcerations between appointments

Appointment Interval	Sample	Mean	Median	SD	Range	P Value
Visit 1-2	13	1.46	1.00	1.94	7.00	0.02*
Visit 2-3	11	0.55	0.00	0.82	2.00	0.13
Visit 3-4	10	- 1.00	0.00	2.00	7.00	0.19

*Significance at P<0.05

Orthodontic Appliances

When observing types of archwires utilized in the subjects completing diaries, nickel titanium and round wire showed an inverse correlation with stainless steel and rectangular wire with subsequent visits. As treatment continued nickel titanium and round wire usage decreased as stainless steel and rectangular wire usage showed an increase (Figures 3-5 and 3-6).

Table 3-1. Frequency of trauma

Visit	Total Diaries	Percent with Trauma
1	17	94.1
2	13	69.2
3	11	27.3
4	10	70.0
5	8	62.5
6	4	25.0

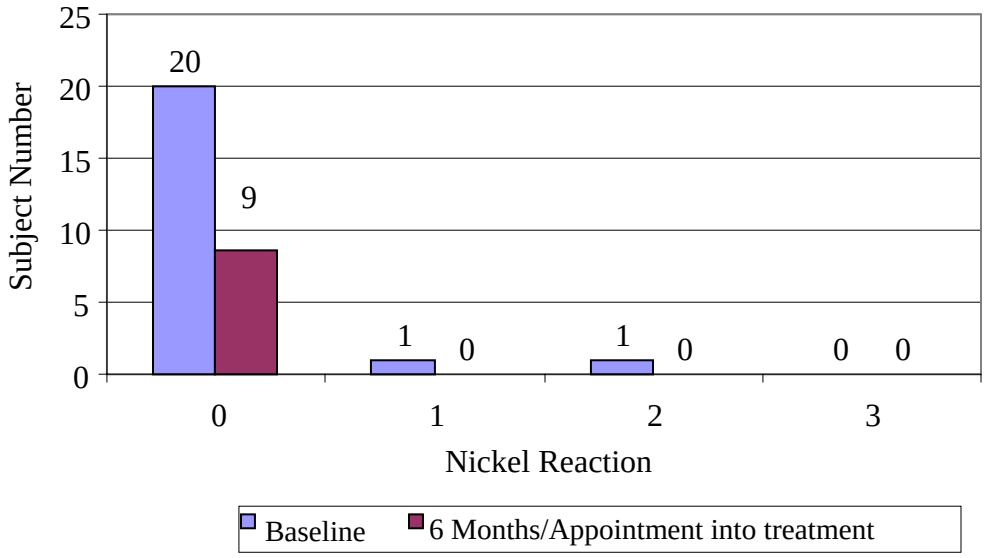

Figure 3-1. Nickel allergy patch results at baseline and six months into orthodontic treatment.

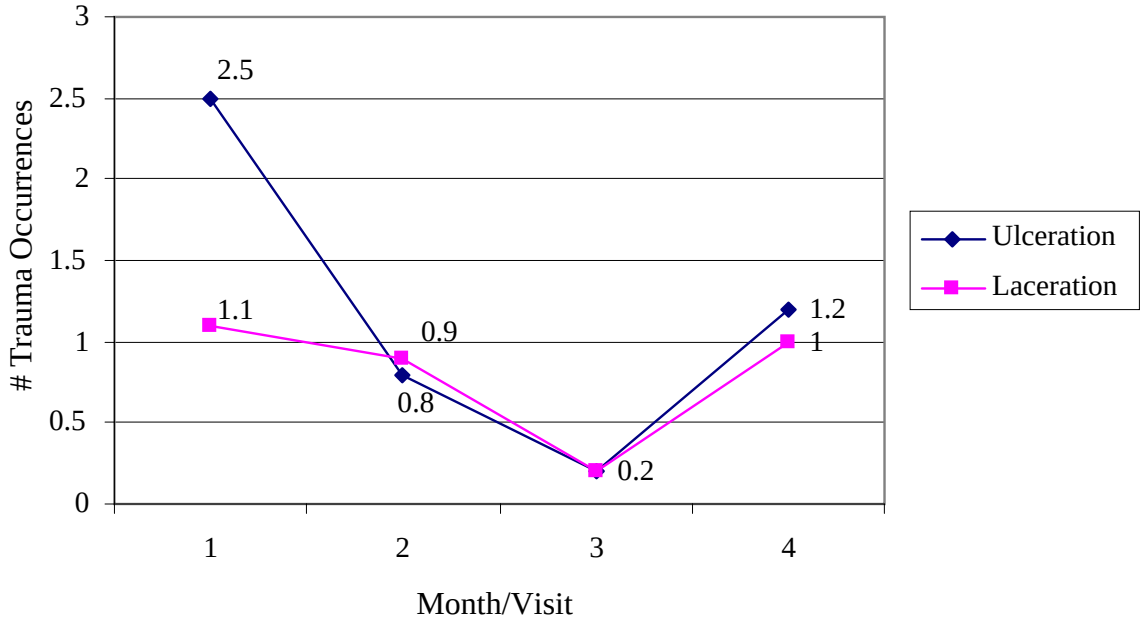

Figure 3-4. Average trauma experienced during the first four regularly scheduled appointments.

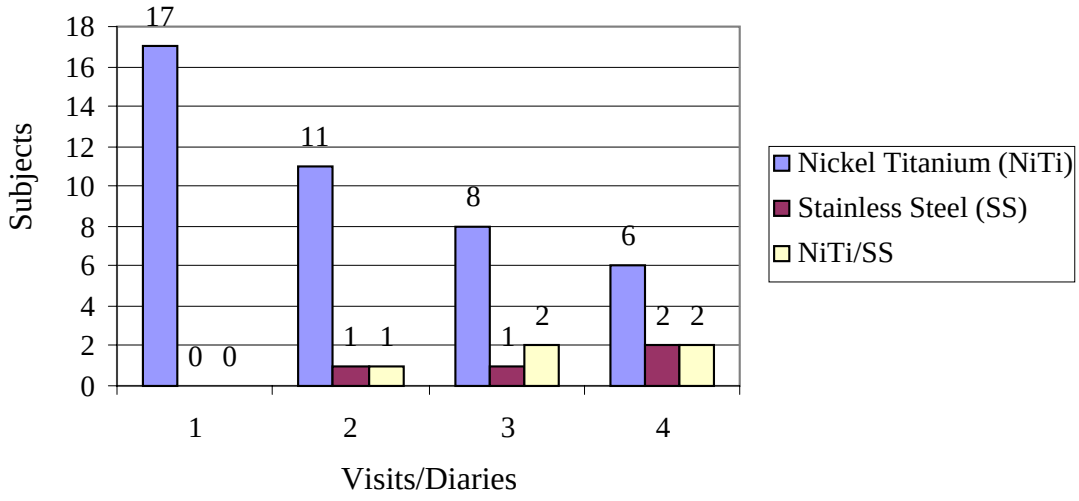

Figure 3-5. Change in archwire compositions with ongoing orthodontic treatment.

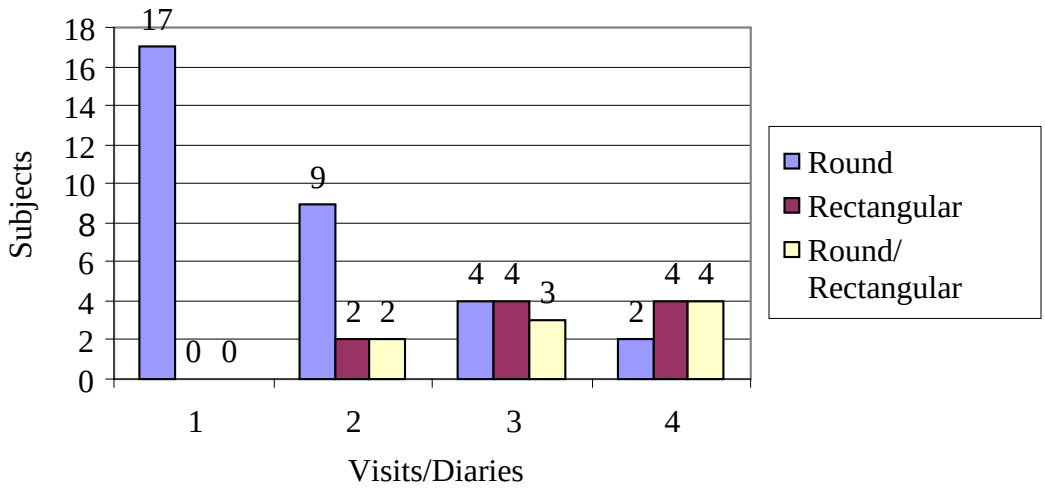

Figure 3-6. Change in archwire dimensions with ongoing orthodontic treatment.

CHAPTER 4
DISCUSSION

Based on the limited sample of 22 subjects undergoing orthodontic therapy in fixed appliances, this study analyzed the prevalence of nickel sensitivity, sensitivity incidence after 6 appointments/visits, and trauma experienced between treatment intervals. One of the main factors contributing to a negative patient experience during orthodontic treatment is discomfort. Discomfort may be caused from the annoyance and novelty of having appliances placed intra-orally, pain from the alteration of the dental and periodontal apparatus, intra-oral trauma, and many other contributory sources. Trauma, laceration and ulceration of the oral soft tissue, was followed to see if it had an impact on nickel sensitivity.

Prevalence of nickel sensitivity among the 22 subjects was found to be 9.1%. When values were examined between sexes, 7.7% of the females tested positive; this result was found to be lower than the numbers found in other studies/sources.[4, 12] On the contrary, male prevalence was at 11.1%, a higher than average finding.[4] The explanation for these skewed values is likely small sample size; of the 22 subjects tested, 9 were male and 13 female. Each sex contained one positive subject. No control sites reacted positively.

Interestingly, both nickel positive participants presented with previous skin piercings for jewelry. A study conducted on 520 men serving in the Swedish military found a significant increase in the sensitivity of nickel; 7.9% tested positive among those men with their ears pierced, while only 2.7% of those without pierced ears showed a positive result.[13] Larsson-Stymne and Widstrom[6] found that among girls with pierced ears, the frequency of girls sensitive to nickel was found to be 13%; only 1% prevalence was found in those without pierced ears. For women, the primary means of sensitization is ear piercing with nickel-plated stud earrings; accessories such as belt buckles, buttons, and other costume jewelry have been shown to cause

nickel reactions to a lesser degree in women.[14,15,16,17,18] All of the female subjects in the present study had piercings prior to orthodontic treatment. Our findings can not support or disprove the data found in earlier studies without a larger sample size of both sexes.

Menne[19] found it difficult to experimentally induce an allergic response to nickel; repeated exposures to high nickel concentrations (10–15%) combined with irritants were needed to produce a reaction. With increased exposure to vascular molecules and the immune system, trauma caused by nickel may trigger a hypersensitivity response. In theory, with trauma or injury inflicted during orthodontic treatment nickel sensitization may occur.

Trauma, in addition to new piercings during treatment, was recorded by patients utilizing a take home diary. Of the 22 patients who underwent baseline patch testing, 17 continued to participate by completing the monthly diaries given at each regularly scheduled appointment, starting the day of appliance bonding. Studies have shown that compliance rates for diaries are inconclusive at best.[20] The biggest flaw with diaries is reliability of the patient to properly document the ulcerations or lacerations experienced.

Reports of ulcerations and small wounds caused by fixed appliances have exceeded 75% in previous studies.[21,22] Findings from the current study showed up to 94.1% of subjects experiencing trauma (Table 3-1). Trauma, particularly ulcerations, showed a decreasing trend for the first three consecutive appointments. Ulcerations of the soft tissue usually occur with orthodontic treatment as brackets and archwires are introduced as new sources of chronic irritation. After initial archwire placement, alignment of the dentition occurs, coinciding with movement of the brackets into new positions. The oral tissues adapt, since most of the misalignment is corrected after the first appointment. Average ulcerative incidents decreased the most between the first and second diary reports (Table 3-3).

Unexpectedly, trauma events increased between the third and fourth diary reports, with significance seen in lacerations (Figure 3-4, Tables 3-1, 3-2, and 3-3). The archwires being utilized during these appointments may provide an explanation for this occurrence. With good alignment, archwire size must increase to provide the dimensions for torque and stiffness for certain mechanics; archwire compositions also contribute to wire stiffness. As orthodontic treatment proceeds, archwires usually move up from nickel titanium to stainless steel and from round to rectangular. The stiffness of the wires may have led to more lacerations experienced by the subjects. With self-ligating and low-friction brackets gaining popularity, more cuts to the soft tissue can be a problem if the archwire is not secured properly by crimpable stop placement and the archwire is allowed to move freely through the brackets.

Most nickel corrosion has been documented to occur early during orthodontic treatment.[9,10] As stated previously, much of the trauma experienced also occurs early in orthodontic treatment. These findings would lead one to infer that more nickel is introduced systemically early in treatment, allowing for increased chances of nickel sensitivity. Even so, of the nine subjects patch tested after 6 months/visits of orthodontic treatment, no positive results were produced. A larger sample is needed to provide more conclusive data.

There have been mixed results in regards to the idea that nickel containing dental materials and products have the ability to elicit nickel sensitization or allergic reaction. Bass et al.[23] and Feasby et al.[24] found correlations between nickel containing orthodontic appliances and increase in sensitization to nickel. The study by Bass et al.[23] resulted in 2 patients out of 29 with an initial negative nickel patch test converting to a positive reaction after 4 months of orthodontic treatment. Other studies have found contrasting results; Menezes et al.[25] conducted a study of 38 patients who received patch test for various substances before orthodontic treatment

and 2 months after the start of orthodontic appliances. There were no significant differences between positive reactions for nickel sensitivity at the two patch test examinations. Janson et al.[26] studied the incidence of nickel sensitivity in 170 patients undergoing comprehensive orthodontic treatment; they were divided into three categories: before, during, and after treatment. No significant difference was determined between the groups, concluding that a nickel reaction was not initiated by orthodontic treatment. The fact that 5 to 12 times the concentration needed to elicit an extra-oral nickel reaction is required to cause sensitization within the oral cavity supports the idea that orthodontic treatment may not induce an allergy.[27] Huang et al.[28] estimated nickel release for a full-mouth appliance to be 131µg in an environment with a pH value of 2.5. This value is below the 600-2500µg needed to induce an allergy and well under the daily dietary intake level of 300-500µg.[29,24] Lack of oral mucosa reactivity to nickel can be explained by a person's innate defenses. A salivary glycoprotein film can form to create a barrier between the allergen presented and the oral mucosa; the richness of vasculature and permeability of the oral mucosa can aid in the dispersion and absorption of allergens.[2]

CHAPTER 5
CONCLUSIONS

The results of this study showed no statistical differences in nickel patch testing results prior to orthodontic treatment and six months after treatment initiation. The sample size did not allow for proper statistical analysis of nickel incidence in a population undergoing orthodontic therapy with regards to trauma.

Orthodontists inform their patients of the risks and benefits that may be experienced during treatment with appliances. The American Association of Orthodontists' informed consent form lists trauma as one of the possible risks. Ulceration or laceration of the oral soft tissue was experienced by a large majority of the treatment population participating in this study. Trauma reports showed significance with initial bracket and archwire placement and with placement of more stiff archwires, composed of stainless steel and/or having a rectangular dimension. No conclusive correlation was assessed with increased trauma and initiation of nickel sensitivity; the literature has conflicting reports. It is assumed that the standard of care for orthodontic treatment should result in minimal discomfort for the patient.

Due to inconclusive data on trauma experienced during orthodontic therapy and nickel sensitivity, it would be in the best interest of the patient to increase patient satisfaction with minimal injury caused by appliances, there by reducing increased systemic nickel exposure. Practitioner awareness and patient education is vital to reduce the risk of creating sensitization or exacerbating a preexisting condition. Standard of care can include cinching archwires, cutting archwires to appropriate lengths, prophylactic placement of wax in areas more prone to ulceration, and proper placement of archwire stops.

APPENDIX A
QUESTIONNAIRE

Name:_____

Address:_____

_____

Phone:(____)_____-_____ Gender: Male ☐ Female ☐

Date of Birth:____/____/____ Age:_____

Occupation:_____

If currently a student, what grade/year?_____

Have you had orthodontic treatment before? Yes ☐ No ☐

Do you currently have any piercings (ear, nose, tongue, etc.)? Yes ☐ No ☐

If yes, check all that apply and date: Ear ☐ __/__/__ Nose ☐ __/__/__

Tongue ☐ __/__/__ Stomach ☐ __/__/__ Eye Brow ☐ __/__/__ Genitals ☐ __/__/__

Other: ☐ __/__/__ List where:_____

_____

<u>General Health:</u> Do you have, or have you ever had the following:

	Yes	No		Yes	No
Heart problems	☐	☐	**Hypertension**	☐	☐
Asthma	☐	☐	**Rheumatic Fever**	☐	☐
Blood disorders	☐	☐	**Cancer**	☐	☐
Tuberculosis	☐	☐	**Diabetes**	☐	☐
Emphysema	☐	☐	**Seizures**	☐	☐
Thyroid Problems	☐	☐	**Arthritis**	☐	☐
Seasonal Allergies	☐	☐	**Allergic Reactions**	☐	☐

If you answered yes to any of the conditions stated above, please specify and give details:_____

_____

Are you currently taking any medications? Yes ☐ No ☐

If yes, please list:_____

APPENDIX B
ORTHODONTIC MAINTENANCE

Patient: _____

Patch test Results: Initial_____

6 Months into treatment_____

Date of treatment start (Bond-up):____/____/____

Bracket system: _____

Archwires(Brand/Type):

Date:__/__/__Initial/First Month: Mx-_____Md-_____

Date:__/__/__ Second Month: Mx-_____Md-_____

Date:__/__/__ Third Month: Mx-_____Md-_____

Date:__/__/__ Fourth Month: Mx-_____Md-_____

Date:__/__/__ Fifth Month: Mx-_____Md-_____

Date:__/__/__ Sixth Month: Mx-_____Md-_____

Emergency Visits:

Date: ____/____/_____

Reason for emergency: _____

If broken wire, what wire and how long has it been broken? _____

_____

Date: ____/____/_____

Reason for emergency: _____

If broken wire, what wire and how long has it been broken? _____

_____

Date: ____/____/_____

Reason for emergency: _____

If broken wire, what wire and how long has it been broken? _____

APPENDIX C
MONTHLY PATIENT DIARY

Patient : _____

Dates of Diary Period: ____/____/____ - ____/____/____

Have you had any new piercings during this period? Yes ☐ No ☐

If yes, where on the body? Ear ☐ Nose ☐ Tongue ☐ Eye Brow ☐ Stomach ☐

Genitals ☐ Other ☐ List where:_____

Check one of the following boxes every time wax is used:

Date	Cut	Ulceration
____/____/____	☐	☐
____/____/____	☐	☐
____/____/____	☐	☐
____/____/____	☐	☐
____/____/____	☐	☐
____/____/____	☐	☐
____/____/____	☐	☐

Did you experience any trauma (Cuts/Ulcerations)?:

Date	Cut	Ulceration	
____/____/____	☐	☐	**How long did it last?_____**
____/____/____	☐	☐	**How long did it last?_____**
____/____/____	☐	☐	**How long did it last?_____**
____/____/____	☐	☐	**How long did it last?_____**
____/____/____	☐	☐	**How long did it last?_____**
____/____/____	☐	☐	**How long did it last?_____**
____/____/____	☐	☐	**How long did it last?_____**
____/____/____	☐	☐	**How long did it last?_____**

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BIOGRAPHICAL SKETCH

Eric Patrick Park was born in Birmingham, Alabama, and reared in Lithia Springs, Georgia. He received his degree of Bachelor of Science in microbiology at the University of Georgia in 2000. In 2004, he was awarded the degree of Doctor of Dental Medicine from the University of Alabama School of Dentistry. Upon completion of his dental training, he continued his education at the University of Florida College of Dentistry, receiving a certificate in orthodontics and Master of Science in 2007.