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Debt and Stress Amongst Orthodontic Residents

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A thesis submitted in partial fulfillment of the requirements for the Master of Clinical Dentistry degree in Orthodontics

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Abstract

Background: The cost of education to become an orthodontist has increased significantly over recent years which has led to an increase in debt of graduating orthodontists.

Aim: This paper aims to assess whether debt amongst orthodontic residents in North America is associated with their stress levels, attitudes towards debt, financial literacy and mathematics anxiety.

Materials and Methods: Web-based software was used to fabricate a questionnaire, based on previously validated scales, in which respondents were asked questions regarding their debt levels, stress levels, attitudes towards debt, financial literacy and math anxiety.

Results: A total of 101 orthodontic residents completed the online questionnaire, for a response rate of 8.6%. The mean debt level was found to be moderately positively correlated to stress level ($r=.51, p<.001$), weakly negatively correlated to knowledge and contemplation of loans ($r=-.31, p<.001$), and moderately negatively correlated to fear of debt ($r=-.55, p<.001$).

Conclusions: Orthodontic resident debt levels are associated with higher stress, as well as their attitudes towards debt.

Keywords: orthodontist, orthodontic education, debt, student loans, stress, attitudes towards debt, financial literacy, math anxiety

Summary for Lay Audience

Background: The cost of university has increased significantly over recent years. This has hit orthodontists particularly hard as they require many years of training at university. To become an orthodontist, a student must first complete an undergraduate degree, then a dental degree, and then a master's degree. This is often over a decade of university training to become qualified. It is unknown whether there is a relationship between high debt levels and stress, certain attitudes towards debt in general, financial literacy and mathematics anxiety.

Aim: The aim of this study was to determine whether orthodontic residents with higher debt levels show higher levels of stress, lower levels of financial literacy and higher levels of math anxiety. An additional aim was to determine whether certain attitudes towards debt (tolerance of debt, knowledge and contemplation about loans, and fear of debt) are associated with higher debt levels.

Materials and Methods: An online survey was created in which respondents were asked questions regarding their debt levels, stress levels, attitudes towards debt, financial literacy and math anxiety.

Results: A total of 101 orthodontic residents completed the online questionnaire. The study found that higher debt levels were related to higher stress levels. In addition, higher debt levels were related to lower knowledge and contemplation about loans, and a higher fear of debt.

Conclusions: Orthodontic resident debt levels are associated with higher stress, as well as their attitudes towards debt

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Chapter 1

1 Introduction

The cost of education to become an orthodontist has increased significantly over recent years which has led to an increase in debt of graduating orthodontists. We have now entered an era where orthodontists are graduating with unprecedented levels of debt, with some orthodontists graduating with over one million dollars of student loans. Research has shown links between debt and stress, thus, there may be an association between an orthodontic residents' debt level and their stress level. In addition, the cause of debt acquisition amongst orthodontic residents is largely unknown and could be related to their attitudes towards debt and financial literacy. Thus, this study aims to investigate whether there are associations between an orthodontic residents' debt level and other important variables including their stress level, attitudes towards debt, financial literacy and math anxiety.

1.1 Debt

1.1.1 Educational Cost Increase

The cost of post-secondary education in North America has increased significantly over recent years which has resulted in an increase in student loan debt. One of the biggest factors behind the national educational debt increase has been the increase in the cost of tuition. The cost of tuition has been on a steady increase over the last three decades. Between 1989 and 1999 in-state tuition and fees at public four-year institutions increased at an average of 3.9% above inflation, while increasing at 5% above inflation between 1999-2009, and further increasing 2.2% above inflation between 2009-2019.¹ This is a total increase of 215% over 30 years. As a result, students have had to increase their debt to pay for their education. From 2004 to 2012 the amount of debt from student loans in

the US tripled to 966 billion.² In 2009 Americans held roughly \$772 billion in student loans.³ By the end of 2019, that total had increased roughly 107% to nearly \$1.6 trillion.³

1.1.2 Educational Increase in Orthodontics

The field of orthodontics has been hit particularly hard by an increase in the cost of tuition, as becoming an orthodontist can require over a decade of university education. Becoming an orthodontist requires first an undergraduate university education followed by a four-year Doctor of Dental Surgery. This is then followed by an orthodontic residency program at an accredited university. The majority of orthodontic residency programs are three years in length, with some universities offering a two-year residency program. For the 2016-2017 academic year, the average tuition cost of a full orthodontic residency was \$103,430.⁴ This represented a 14.2% increase since the 2012-2013 academic year. The average debt of an orthodontist graduating today is \$428,150, with 26% of orthodontists expecting to have \$600,000 or more in debt by the time of graduation.⁴ Recently, there have even been cases of orthodontists graduating with over one million dollars in debt.⁵ This level of debt is unprecedented and potentially burdening future orthodontists with a lifetime of debt.

1.1.3 Negative Effects of Debt

Debt has been shown to have detrimental effects on mental health.⁶ In February 2017, Bloomberg reported that 39% of millennials would rather tell a potential partner about some of their most personal information than discuss their debt.⁷ More than half (53%) of Americans agree that thinking about their finances makes them anxious, and 44% feel that discussing their finances is stressful, with respondents aged 18-34 reporting the highest levels of stress (63%) and anxiety (55%).⁷ With respect to gender differences, single women are more likely than their male counterparts to feel anxious or stressed about their finances.⁷ Sixty-one percent of single women feel anxious thinking about their

finances compared to 52% of single men.⁷ Similarly, 52% of single women feel stressed discussing their finances compared to 42% of single men.⁷

1.1.3.1 The Influence of Debt on Future Practice

In addition to these adverse health outcomes, numerous studies have been performed which show the way increased debt affects how dentists practice after graduation. Nicholson et al⁸ found that more debt caused dentists to work longer hours, while Nashleanas⁹ found students with debt over \$100,000 were more likely to enter private practice. Boyles¹⁰ found that dentists with higher levels of debt were less likely to specialize and more likely to enter private practice, accept higher paying jobs on graduation, and work longer hours.

With respect to orthodontists, Pruzansky et al¹¹ found that the size of orthodontic residents' loans significantly influences their career decisions. Debt was found to influence an orthodontist's decision to purchase a practice, work as an associate, work full time vs part time and even affect their location of practice. Stoker et al¹² found that a total of 58% of respondents reported that their educational debts restricted them from pursuing a full-time academic career. This study further confirms the concerns of educators and professional organizations that the future of orthodontic education is in a crisis situation because of the lack of full-time orthodontic professors.¹² The level of orthodontists who wish to pursue a career in academics has been shown to be as low as 4.5%, whereas 40% reported that they would be interested in full-time academics if the salaries at universities improve.¹² The high level of financial commitment of studying orthodontics is likely preventing orthodontists from pursuing lower paying fields such as academics. Furthermore, Stoker¹² found that 62% of respondents affirmed that debt will influence their decisions about where to work after their residency, with higher amounts of both orthodontic and total educational debts significantly associated with these affirmations.

The way debt changes a dentist's career may negatively impact the way they provide care to society. Graduates facing higher levels of debt may shift their focus onto repaying their loans at the expense of volunteering and treating the vulnerable population.¹³ Ackerman et al¹³ concluded the requirement to pay off education debt ranging into the hundreds of thousands of dollars could deter recent graduates from providing care to the special needs population. This is a significant issue as it has been estimated that in 2012 there were almost 38 million people in the United States with severe disabilities. These individuals have increased risk and burden of disease, a likelihood of not seeking preventive or early treatment, and the inevitability of experiencing far greater adverse effects such as recurrent infections and social isolation. While new graduates are expressing a willingness to provide care for vulnerable populations, only 10% of general dentist's report that they treat children with cerebral palsy, intellectual disabilities or medically compromising conditions often or very often.¹³ Consequently, increased debt of dental graduates may create strain on the underserved population of society.

Increased debt affects a dentist's decision to enter the armed forces. There is a decrease in the proportion of graduates who plan on entering the armed forces who have accumulated higher debt levels. This ranges from 30 percent for individuals with less than \$30,000 in education debts to 3 percent or less for graduates with \$150,000 or more in debt.¹⁵ Thus, there are many aspects of a dentist's career which can be influenced by their debt load and potentially negatively impact society.¹⁵

1.1.4 The Influence of Debt on the Wider Medical Community

The effect of student debt on a student's career extends beyond the field of dentistry into the wider medical community. Pisaniello et al¹⁶ performed a systematic review on how debt affects medical residents. The review showed that the majority of studies found that medical student debt was associated with pursuit of higher paying specialties. It was also

found that financial stress was high amongst medical students and correlated with debt. Debt was also found to be associated with poorer academic performance.

1.1.5 The Influence of Debt on Personal Lives

In addition to the effects of debt on students' careers, debt also affects personal aspects of their lives. Rohlfsing et al¹⁷ found medical student debt and particularly debt relative to peers at the same institution appears to influence the way that students approach major life choices, like when to start a family and when to buy a home. Pruzansky et al¹¹ found that educational debt influenced lifestyle decisions of orthodontists such as saving for retirement, getting married, starting a family and buying a home.

1.1.6 Paperless Money

Spending habits of students is influenced by having educational loans available to them. These spending habits are further influenced by student loans being available in the form of a paperless currency. Priya et al¹⁸ found that individuals are more likely to spend money when it is in paperless form (ie credit card or gift card) than when paying with cash. This is consistent with the argument that paperless forms of transaction are less transparent than cash and are treated like play money. They even found participants spent more when paying by paperless forms than when paying by cash even for frequently purchased utilitarian goods. Prelec et al¹⁹ found that willingness-to-pay can be increased when students are instructed to use a credit card rather than cash. The effect may be large (up to 100%) and it appears unlikely that it arises due solely to liquidity constraints. Thus, individuals spend more money when it is paperless than when paying for items in cash. In addition, Wilcox et al²⁰ found that students with higher levels of debt were more likely to spend more and add to their debt, than students with lower levels of debt, suggesting that with higher levels of debt student spending actually becomes worse.

These studies indicate that once students have access to credit they are more likely to increase their spending habits and increase their debt.

1.1.7 Interest Rates

A consequence of students using credit is the associated interest rate when repaying money. Studies have suggested that students are more susceptible to high interest rates when they are already familiar with the use of credit. Fagerstrøm et al²¹ found students who normally used credit cards were willing to buy a phone at a very high interest rate (nearly 40%) rather than save up for a desired cellular phone. However, students who did not normally use a credit card would prefer to wait until they saved up enough money to purchase the phone outright.²¹ This study demonstrates that in some cases immediate availability of a much-desired product may induce credit spending with extremely high interest rates for students who are used to having credit available to them.²¹ Thus, this habit may extend to students who may choose to use their educational loans to finance these types of purchases despite the increased cost resulting from the associated interest rate.

1.2 Stress

1.2.1 Stress and Debt

Increased debt has been linked to increased stress.²² Boyles et al¹⁰ found that high dental school debt increased stress levels for general dentists in England. They found that students who accumulated over \$40,000 in debt were more likely to be stressed than students who accumulated less than \$40,000 debt. This level of debt is only a fraction of what orthodontists in North America usually accumulate, and yet still created negative psychological effects. Educational debt has been shown to impact students' lives for years after they have graduated.⁶

Debt stress is often a catalyst for “stress proliferation,” in which one stressor leads to the formation of multiple others.⁶ Sweet et al²³ found higher levels of debt may also contribute to negative health outcomes, including higher diastolic blood pressure, obesity, poor mental health, as well as poor general health. Systematic reviews performed by Richardson et al²⁴ showed associations between higher levels of debt and various mental health and substance abuse problems for doctors. Rohlving²⁵ found student loan debt has been linked to stress, burnout, and suicidal thoughts among medical trainees (eg, students and/or residents). In addition, Cooke et al²⁶ concluded that undergraduate students with higher debt felt more tense, criticized by others, unhappy, and irritable than students with less or no debt. Amongst orthodontists, Stoker et al¹² found 72% of respondents expressed varying levels (mild, moderate, or major) of anxiety because of their student debt. Higher amounts of both orthodontic and total educational debts were significantly associated with higher levels of anxiety. This study used self-reported stress levels and did not use a validated stress questionnaire.

1.2.2 Measuring Stress

Psychological stress occurs when an individual perceives that environmental demands tax or exceed his or her adaptive capacity.¹⁴ Operationally, studies of psychological stress focus either on the occurrence of environmental events that are consensually judged as taxing one's ability to cope, or on individual responses to events that are indicative of this overload, such as perceived stress and event-elicited negative affect.¹⁴ There are various tools that have been developed to measure an individual's stress level. Some widely used tools include the Depressive Symptomatology Scale, the Hassles Scale, the Anxiety Stress Scales and the Perceived Stress Scale.¹⁴

The “Perceived Stress Scale” is a widely used psychological instrument for measuring the perception of stress and was developed by Sheldon Cohen.¹⁴ It is a measure of the degree to which situations in one’s life are appraised as stressful. Items were designed to tap how unpredictable, uncontrollable, and overloaded respondents find their lives. The scale also includes a number of direct queries about current levels of experienced stress. Systematic review of the Perceived Stress Scale has shown it demonstrates internal consistency reliability, factorial validity, and hypothesis validity.¹⁴

1.3 Attitudes Towards Debt

One of the major aspects of the student loan epidemic is the fact that students are voluntarily amassing such large loans. Thus, there is major interest in the cause of debt acquisition by students. This has been a recurrent source of research in economic psychology, and a good part of this research has concerned students’ “attitude towards debt”.²⁷ For such research it is important that attitudes to student debt can be measured reliably and validly, and to know if one or more constructs are being measured.²⁷ This is important as it will allow insight into the factors that are causing students to go into high levels of debt.

1.3.1 Measuring Attitudes Towards Debt

There have been various scales by many authors to measure attitudes towards debt. A recurring theme amongst measuring attitudes towards debt has been a distinction of “pro-debt” attitudes and “anti-debt” attitudes. Scott and Lewis²⁸ found that 11 of the 14 items of the Attitudes to Debt Scale (ADS) loaded on 2 factors: anti-debt attitude and pro-debt attitude. Similarly, Van Dyke and Little²⁹ reported 3 factor themes about attitudes toward debt: liberal (pro-debt), moralistic/debt averse (anti-debt), and fearful about debt. Haultain et al²⁷ reported 2 factors conceptualized as debt utility (pro-debt) and fear of

debt (anti-debt) in their study. Park et al³⁰ utilized a tolerant attitudes theme (pro-debt) and a fear of debt theme (anti-debt). In addition, Park et al³⁰ uniquely created a “contemplation and knowledge about loans” theme.

1.3.1.1 Pro-Debt Attitudes (Tolerant Attitudes Towards Debt)

Pro-debt attitudes are a measure to assess how open students are to the idea of taking on debt. The Centre for Higher Education Research and Information (CHERI) and London South Bank University submitted a report to Universities UK detailing the higher education students’ attitudes to debt and term-time working and their impact on attainment.²⁹ The report found that 73% of students felt borrowing money for a university education is a good investment.²⁹ In addition, they found that 63% of students believed debt is a normal part of today’s lifestyle.²⁹ There is current research suggesting that students with loans are more comfortable with debt and are more likely to have other forms of debt outside their loans. Callender and Wilkinson³¹ showed that in 2002/03, 72 per cent of students with loans also had other forms of commercial credit compared with only 46 per cent of students without loans. Thus, students may be inclined to use their student loans for other aspects of their lives and not just to cover their education expenses.

1.3.1.2 Anti-Debt Attitudes (Fear of Debt)

Anti-debt attitudes are a measure to assess how against students are to the idea of taking on debt. The survey of higher education students’ attitudes to debt by the Centre for Higher Education Research and Information (CHERI) and London South Bank University found that 73% of students were seriously worried about the debts they are building up while at university.³² Callender and Wilkinson³¹ found that poorer high school students had a greater fear of debt than students from middle or upper socioeconomic class. This fear of debt made the students more sensitive to the amount of

debt they would accrue. This sensitivity was seen in the impact on their choice of university to keep the debt they accrue to a minimum. As a result, they found students with a greater fear of debt were more likely to attend a university where the cost of living was lower; was near their home; and where the prospects of term-time employment were good.³¹ Surprisingly, Chisholm-Burns et al⁶ found that greater “fear of debt” was correlated with increased pharmacy school loan debt. The authors stated that as a student’s debt level increased, it was reasonable to assume that their fear of this debt increased.

1.3.1.3 Knowledge and Contemplation of Loans

Knowledge and contemplation about loans was introduced by Park et al³⁰ and aimed to assess whether a student’s contemplation and knowledge about loans influences the amount of debt they accrue. There is current research in this area with respect to pharmacy students. Chisholm-Burns et al⁶ found greater “contemplation and knowledge about loans” was correlated with lower estimated total student loan debt for pharmacy students. They also found that those students with greater contemplation and knowledge about loans planned on paying their loans off sooner, thus minimizing the compounding interest on their loan.⁶ In addition, research performed by Walton et al³³ found that Canadian dental students consistently underestimated the total cost of dental school. This underestimation of costs was so extreme that they found 15.2% of students at the University of British Columbia enrolled in the 2003-2004 academic year would not enroll in the program if given the opportunity to start again.³³ This suggests that some students might exhibit poor contemplation and knowledge about loans before embarking on a dental school education.

1.4 Financial Literacy

Students financial literacy is crucial, as it analyses how seriously they scrutinize the financial impact of their studies. Lusardi³⁴ defines financial literacy as the ability to process economic information and make informed decisions about financial planning, wealth accumulation, debt, and pensions. It is important to study financial literacy to determine whether students are amassing large levels of debt due to their poor financial literacy skills.

1.4.1 Measuring Financial Literacy

In order to measure financial literacy based on these key concepts, Lusardi³⁴ created a questionnaire consisting of five questions. The questions cover the fundamental concepts of economics and personal finance. With one exception, the questions do not require complex calculations. The questions focus on interest rates and inflation, principles relating to risk and diversification, the relationship between bond prices and interest rates, the impact that a shorter term can have on total interest payments over the life of a mortgage, and compounding interest on a loan.³⁵

This questionnaire has been used extensively around the world as a way of measuring an individual's financial literacy. After implementing these questions in the 2004 Health and Retirement Survey (HRS) module for a sample of over 1,200 respondents age 50+ they were thoroughly tested in other data sets using respondents from different age groups and time periods, and using different data collection methods.³⁶ For instance, they were added to wave 11 of the National Longitudinal Survey of Youth (NLSY) for 2007-08 covering respondents age 23-28 years.³⁷ These questions were also added to a module in the American Life Panel in 2008, an Internet-based panel data set.³⁷ Finally, these questions were added to the 2009 Financial Capability Study (FINRA), which included both phone interviews with a representative sample of the US population, and an Internet survey of about 500 respondents in each state.³⁶ Across the board, these variables do a good job of

characterizing peoples' levels of financial knowledge; moreover, they strongly correlate with financial behaviors.³⁴

1.4.2 National Financial Capability Study

These financial literacy questions were recently used again in the 2018 National Financial Capability Study. The National Financial Capability Study (NFCS) is a large-scale, multi-year project that measures Americans' financial capability. The FINRA Investor Education Foundation commissioned this national study in consultation with the U.S. Department of the Treasury and other federal agencies. The NFCS was first conducted in 2009 and then repeated every three years. This was a study that involved over 25,000 participants across the USA and had many findings.³⁵

The analysis found a strikingly low level of financial literacy amongst millennials. The study found in 2018 only 16% of young adults (age 18-37) demonstrated financial literacy. This was a significant decrease from 38% when the same questionnaire was given to young adults (age 18-37) in 2009.³⁵ The 2015 NFCS data shows that many borrowers did not fully comprehend what they were taking on when they obtained their loans, further indicating that many student loan borrowers are not fully aware of the choices they made. More than half of student loan holders (54 percent) did not try to figure out how much their future monthly payments would be before taking on their loans.³⁵ Of these respondents, 53 percent said that they would make a change if they could go through the process of taking out loans all over again.³⁵ Furthermore, 17 percent did not know how to answer the question, which may mean that they still do not know whether they made the right choice. Those who tried to estimate monthly payments before obtaining the student loan are 15 percentage points more likely to report that they would take the same actions (39 percent vs. 24 percent). In contrast, borrowers with private student loans are more likely to say they would make a change in the decision-

making process (60 percent compared to 51 percent among those with just federal loans).³⁵

1.4.3 The National Student Financial Wellness Study

The National Student Financial Wellness Study (NSFWS) is a national survey of college students examining the financial attitudes, practices and knowledge of students from institutions of higher education across the United States, and was developed and administered by The Ohio State University. The purpose of the 2014 NSFWS is to gain a more thorough and accurate picture of the financial wellness of college students.⁴⁰ The study included a section on “financial knowledge and education”. They found that a moderate proportion of students have participated in personal financial courses or events: 30.6% of students report attending a class/workshop in high school and 22.9% of students report they have attended a class/workshop in college. Students were asked a series of five financial knowledge questions. On average, students correctly answered three questions.⁴⁰

1.4.4 Financial Literacy, Education, and Downstream Behaviors

Fernandes et al⁴¹ conducted a meta-analysis of the relationship of financial literacy and financial education, to financial behaviors in their paper "Financial literacy, financial education, and downstream financial behaviors". Their analysis included 168 papers covering 201 prior studies. They developed a 13-item scale with excellent psychometric properties, distilled from 26 items used in numerous prior studies. This 13 item scale consisted of the five questions included in the NFCS project along with eight other questions.⁴¹

1.4.5 The Importance of Financial Literacy

Research has shown the effect of financial literacy on wealth. Financial literacy is strongly correlated with behavior that is indicative of financial capability.³⁵ Specifically, those with higher literacy are more likely to plan for retirement and to have an emergency fund and less likely to engage in expensive credit card behaviors.³⁵ Financial literacy also correlates with financial well-being, such that those with higher financial literacy also have higher financial well-being scores.³⁵ Stango and Zinman⁴² showed that those who are unable to correctly calculate interest rates out of a stream of payments end up borrowing more and accumulating lower amounts of wealth. Lusardi and Tufano³⁷ find that those who severely underestimate the power of interest compounding are more likely to experience difficulties accumulating wealth. Agarwal et al⁴³ show that financial mistakes are most prevalent among the young and the elderly—demographic groups that display the lowest levels of financial knowledge and cognitive ability. Hilgert et al⁴⁴ also document a positive link between financial knowledge and financial behavior. According to Gerardi et al⁴⁵ a lack of numerical ability was a strong predictor of mortgage defaults.

Thus, financially savvy people are more likely to accumulate wealth.⁴⁶ There are several explanations for why higher financial literacy translates into greater wealth. Several studies have documented that those who have higher financial literacy are more likely to plan for retirement, probably because they are more likely to appreciate the power of interest compounding and are better able to do calculations.³⁷ Studies have shown that these issues persist worldwide, with low levels of financial literacy across countries correlated with ineffective spending and financial planning, and expensive borrowing and debt management.³⁶

Financial literacy is also associated with higher returns on investments and investment in more complex assets, such as stocks, which normally offer higher rates of return. This finding has important consequences for wealth; according to the simulation by Lusardi et al⁴⁸, in the context of a life-cycle model of saving with many sources of uncertainty, from 30% to 40% of US retirement wealth inequality can be accounted for by differences in

financial knowledge. These results show that financial literacy plays a crucial role in saving and wealth accumulation.⁴⁸

With respect to debt behavior, individuals who are more financially literate are less likely to have credit card debt and more likely to pay the total balance of their credit card each month rather than just paying the minimum due.³⁵ Those with higher financial literacy levels also are more likely to refinance their mortgages when it makes sense to do so, tend not to borrow against their 401(k) plans, and are less likely to use high-cost borrowing methods, e.g., payday loans, pawn shops, auto title loans, and refund anticipation loans.⁴⁹ Several studies have documented poor debt behavior and its link to financial literacy. Lusardi and Tufano⁵¹ reported that the least financially literate are also more likely to have costly mortgages. They showed that the least financially savvy incurred high transaction costs, paying higher fees and using high-cost borrowing methods. In their study, the less knowledgeable also reported excessive debt loads and an inability to judge their debt positions.⁵¹ Similarly, Mottola⁵² found that those with low financial literacy were more likely to engage in costly credit card behavior. In addition, research has shown that the least financially literate individuals were more likely to borrow against their 401(k)s and pension accounts.⁵²

1.4.6 Financial Literacy and Student Loans

With respect to the debt associated with student loans, studies have shown that young people struggle to comprehend their loans. According to Lusardi et al⁵³, Millennials know little about their student loans and many do not attempt to calculate the payment amounts that will later be associated with the loans they take. When asked what they would do, if given the chance to revisit their student loan borrowing decisions, about half of Millennials indicate that they would make a different decision. Lusardi⁵³ found only 27% of students could do simple interest rate calculations. Currently in the United States loans made during the 2018–19 award year have the rate fixed at 7.6% for the life of the loan

which begins accumulating as soon as the borrower accepts the loan.⁵⁵ As many orthodontists can be studying for over a decade, the effects of compounding interest can be staggering.

1.4.7 Financial Literacy Amongst Orthodontic Residents

Consequently, research has shown various links between financial literacy and debt. In January 2018 the American Association of Orthodontists (AAO) conducted a survey on student loan debt.⁵⁶ Some of the responses included quotes like “I have more interest alone that my family members have in debt coming out of school” and “I am fearful to let my own children become orthodontists because of the overwhelming debt I am facing”. Many orthodontists are now graduating with loan repayments bigger than their mortgage.⁵⁶ This suggests that orthodontic residents have poor financial literacy in regards to their student loans.

1.5 Math Anxiety

Mathematical anxiety is defined as feelings of tension, apprehension, or fear that interfere with math performance.⁵⁷ It has been widely demonstrated that individuals with high levels of math anxiety perform worse than their peers with low levels of anxiety in simple numerical tasks, such as counting or numerical comparison.⁵⁸ Thus, due to the complex mathematical nature of student loans there may exist a link between student loans and math anxiety. This may result as individuals who shy away from math may intentionally avoid thinking about their student loans and confronting the financial implications of their loans. There have been various questionnaires developed to measure math anxiety including the 98-item Math Anxiety Rating Scale (MARS) to measure math anxiety,⁵⁷ the 12-item Fennema-Sherman Mathematics Anxiety Scale,⁵⁹ and the single item math anxiety scale (SIMA).⁶⁰

1.6 Problem Statement

The effect of student loans is having a detrimental impact on students. The student loan epidemic is approaching crisis levels in the orthodontic community as orthodontists are burdening themselves with a lifetime of debt. It is vital to understand the causes and effects of orthodontics residents' debt acquisition. Currently, there is no literature on the relationship between an orthodontic residents' debt level and their stress level, their attitude towards debt, their financial literacy and their math anxiety.

1.7 Purpose

The primary purpose of this study is to determine whether there is a relationship between educational debt and stress amongst orthodontic residents.

The secondary purposes of this study are to determine whether there is a relationship between an orthodontic resident's debt and attitudes towards debt (broken down into three subsections - tolerant attitudes towards debt, knowledge and contemplation about loans, and fear of debt); to determine whether there is a relationship between an orthodontic resident's debt and their financial literacy; and to determine whether there is a relationship between an orthodontic resident's debt and their math anxiety.

1.8 Hypothesis

Primary Hypothesis:

1: It is hypothesized that orthodontic residents with higher debt levels, will have higher levels of perceived stress.

Secondary Hypotheses:

2: It is hypothesized that orthodontic residents with higher debt levels, will have more tolerant attitudes towards debt.

3: It is hypothesized that orthodontic residents with a higher debt levels, will have less knowledge and contemplation of loans.

4: It is hypothesized that orthodontic residents with higher debt levels, will have a greater fear of debt.

5: It is hypothesized that orthodontic residents with higher debt levels, will have lower financial literacy.

6: It is hypothesized that orthodontic residents with higher debt levels will have higher levels of math anxiety.

Chapter 2

2 Materials and Methods

2.1 Study Design

The study design was a cross-sectional survey. An online survey was created and distributed to current and recently graduated orthodontic residents in North America who are members of the American Association of Orthodontics (AAO). All orthodontic residents in North America are strongly encouraged to become members of the AAO, and this was determined to be the most efficient way to approach the majority of orthodontic residents in North America.

2.2 Ethics Approval

The study received approval from the Health Sciences Research Ethics Board (HSREB #115174) at Western University (Appendix 5).

2.3 Development of the Questionnaire

The survey was adapted from the 2017 attitudes towards debt scale developed by Park et al³⁰, the 1994 stress scale developed by Cohen et al⁶², the 2014 financial literacy scale developed by Fernandes et al⁴¹, and the single item math anxiety scale from Nunez-Pena et al⁶⁰ (refer to Appendix 2 for full questionnaire). The survey had 6 domains: debt, perceived stress, attitudes towards debt, financial literacy, math anxiety and demographics.

2.3.1 Debt Domain

Residents were asked three aspects of their debt: their anticipated debt upon graduation of orthodontic residency (or the debt they had upon graduation of orthodontic residency if they are a recent graduate), their debt upon graduation from dental school and their current non-educational related debt.

2.3.2 Perceived Stress Domain

The perceived stress domain (“the degree to which situations in one’s life are appraised as stressful”) was measured using the 10-item Perceived Stress Scale (PSS-10) developed by Cohen⁶². The Perceived Stress Scale consists of 10 questions designed for use in community samples with at least a junior high school education and has undergone considerable testing, providing evidence of its validity and reliability.⁶² Roberti and colleagues⁶⁵ reported a Cronbach’s alpha of .89, indicating good internal consistency. Systematic review of the Perceived Stress Scale has shown it demonstrates internal consistency, reliability, factorial validity, and hypothesis validity.¹⁴ Likert-type responses for each item range from 0 (Never) to 4 (Very Often), with 2 as a neutral value. Four items were reverse-coded by the author. The scoring of these items was reversed to be consistent with the direction of the scoring for the remaining six items. Scores on the PSS-10 range from 0-40, with higher scores indicating greater perceived stress.

2.3.3 Attitudes Towards Debt Domain

The attitudes towards debt domain was measured using an 11-item scale developed by Park and colleagues³⁰, which had acceptable internal consistency as indicated by a Cronbach’s alpha of .64. The scale was adjusted slightly to be applicable to orthodontic residents. Likert-type responses for each item range from 1 (Strongly Disagree) to 5 (Strongly Agree) with 3 as a neutral value. Three items were reverse-coded by the

authors (and also reverse scored) to be consistent with the scoring of the remaining items with 3 remaining unchanged as the neutral value.

The attitudes towards debt domain was divided into three subscales: fear of debt, knowledge and contemplation about loans, and tolerant attitudes towards debt. The “fear of debt” subscale consisted of 3 questions (scores ranging from 3-15, with a higher score indicating less fear of debt). The “fear of debt” sub-scale assesses students’ level of worry/concern regarding debt.³⁰ The “knowledge and contemplation about loans” subscale consisted of 4 questions (scores ranging from 4-20, with a higher score indicating greater knowledge and contemplation about loans). The “knowledge and contemplation about loans” sub-scale assesses how thoughtful students are regarding taking on debt and loans, and if students are familiar with the terms of their loans.³⁰ The “tolerant attitudes towards debt” sub-scale consisted of 4 questions (scores ranging from 4 to 20, with a higher score indicating more tolerant attitudes towards debt). The “tolerant attitudes toward debt” sub-scale assesses how open students are to the idea of taking on debt.³⁰

2.3.4 Financial Literacy Domain

The Financial Literacy domain was based off the 13-item scale developed by Fernandes et al⁴¹ and the 5-item scale developed by Lin et al³⁵ used in the NFCS project. The questionnaire wording was altered slightly to be applicable to orthodontic residents, and the actual number values were changed so that answers could not be easily searched. In addition, a question from the National Student Financial Wellness Study⁴⁰ was added. In total, this domain consisted of five questions deemed most relevant to debt acquisition by orthodontic residents. Each question had one correct answer and one point was awarded for each correct answer. Thus, the total score ranged from 0-5 with a higher score indicating a higher level of financial literacy.

2.3.5 Math Anxiety Domain

The Math Anxiety domain was measured using the single item math anxiety scale (SIMA). This scale is based on the item suggested by Ashcraft et al⁶⁶ and Núñez-Peña et al⁶⁰, who showed it provides valid and reliable measures of mathematical anxiety.⁶⁰ The scale consists of one question which has a sliding scale from 1-10 with a higher score representing a higher level of math anxiety.

2.3.6 Demographics Domain

The demographics domain included questions about the participants age, race, marital status, current debt level and anticipated debt level upon graduation amongst others. Questions about residents plans after graduation, what they did between dental school and orthodontic residency, and anticipated earnings were also included in this section.

2.4 Survey Software

Qualtrics® (Qualtrics, 2019, Provo, UT) web-based software was used to fabricate the online questionnaire. An informed consent information package was also included for respondents describing the study in detail. The survey consisted of 52 questions and was estimated to take each respondent approximately 10-15 minutes to complete (refer to survey in Appendix 2).

2.5 Incentives Provided to Participants

No direct benefits were offered to participants. Indirect benefits included contribution to education and research in orthodontics. Participation was voluntary and individuals could

withdraw from the study at any time. Information was collected anonymously and thus individuals could not withdraw their data from the study once the survey was completed.

2.6 Recruitment of Respondents

The survey was distributed to 1178 current orthodontic residents and recent graduates in North America who are registered as student members of the American Association of Orthodontists (AAO). The AAO distributed the survey through their “Partners in Research” program. This program was established for the distribution of research surveys on behalf of educational institutions, researchers and students. An initial email invitation to participate in the survey was sent to AAO student members on the 13th of October 2020, with a follow up email sent on the 28th of October 2020, to remind individuals to participate in the survey. This email provided respondents with a URL link used to direct them to the survey. Individuals who did not opt to complete this survey within this time frame were deemed non-responders and were not contacted further. Inclusion criteria included being a student member in North America of the AAO. Exclusion criteria included declined consent. The survey results were downloaded from the Qualtrics website on 13th November, 2020, allowing for a data collection period of 30 days.

2.7 Statistical Analysis

Data was downloaded from Qualtrics® software into Microsoft Excel® spreadsheet format in order to manipulate the data. The data sets were ordered by a randomly assigned respondent number and then transferred to SPSS statistical package version 23 (SPSS Inc., Chicago, IL). Descriptive statistics, including mean, median and standard deviations, were calculated for all demographic variables as well for the variables of interest (debt, tolerant attitudes towards debt, knowledge and contemplation about loans, fear of debt, financial literacy, perceived stress, and math anxiety). The majority of

variables were found to be normally distributed. Hypotheses were tested through bivariate analysis, and by calculating the Pearson correlation coefficient (r) between the variables of interest and debt (in dollars) anticipated upon graduation of orthodontic residency. A One-Way Analysis of Variance was performed, along with a Tukey multiple comparison test, to compare debt levels amongst different demographic groups. Statistical significance was set at $p < .05$.

Chapter 3

3 Results

The results will be presented by first outlining the demographics of respondents and the breakdown of debt of the respondents. This will be followed by presentation of the variables of interest and correlational analysis of the variables of interest. The variables of interest will then be analyzed in further detail in the order: stress, attitudes towards debt, financial literacy and math anxiety. A summary of findings relating to the hypotheses will then be presented. This will be followed by other findings of the study not pertaining to the hypotheses, but of worthy of mention.

3.1 Demographics

The online questionnaire was distributed to 1178 student members of the American Association of Orthodontists. One hundred and eight responses were received, equaling 9.2% of student members. One respondent selected “no” in response to the letter of information and consent, and was directed to the end of the survey. Seven responses completed less than 17% of the survey and were removed from data analysis. Thus, one hundred and one responses (representing an 8.6% response rate) were used in the data analysis.

The demographics of residents is outlined in Table 1. The majority of respondents were female, white, and American, and within the age bracket 28-30 years old. Respondents were relatively evenly distributed when looking at marital status and residency year. Most did not have children.

Table 1: Demographics of Orthodontic Residents (N=101)	
	Number (%)
Gender	
Female	61 (60.3)
Male	39 (38.6)
Other	1 (1.0)
Race	
White	68 (67.3)
Hispanic/ Latino	7 (6.9)
Black/ African American	3 (3.0)
Asian (East, South, South East)	19 (18.8)
Middle Eastern/ Arab American	2 (2.0)
Other Minority	2 (2.0)
Citizenship	
American	78 (77.2)
Canadian	17 (16.8)
Other	6 (5.9)
Marital Status	
Single	49 (48.5)
Married	48 (48.5)
Divorced	0 (0)
Other	4 (4.0)
Number of Children	
0	82 (81.2)
1	7 (6.9)
2	5 (5.0)
3	2 (2.0)
4+	5 (5.0)
Age	
27 and younger	16 (15.8)
28-30	49 (48.5)
31-33	21 (20.8)
34-36	5 (5.0)
37 and older	10 (10.0)
Residency year	
1	25 (24.8)
2	29 (28.7)
3	24 (23.7)
Recently graduated	23 (22.8)

Residents were asked details about their orthodontic residency (Table 2). The mean program length was 32.4 months with the shortest program being 24 months and longest program being 60 months. The median yearly program tuition was \$57,000 and the mean yearly stipend was \$8,613 for all residents. Of the residents who reported a stipend (33% of respondents), the mean yearly stipend was \$26,363.

Table 2: Orthodontic Residency Details

	N	Minimum	Maximum	Mean	Std Deviation	Median
Length of program (months)	101	24	60	32.4	4.9	34
Program yearly tuition (\$)	101	0	200,000	55,237	35,040	57,000
Program yearly stipend (\$)	101	0	100,000	8,613	19,718	0

Residents were asked about their experience prior to residency and their anticipated plans upon graduation of their orthodontic residency (Table 3). The majority of residents (51.5%) started their residency immediately after dental school. The majority (80.0%) are planning to work at a private orthodontic practice after graduation. The majority of residents planned to pay their debt off in 10 years or less, with over 12% of residents anticipating it will take them longer than 20 years to repay their debt.

Table 3: Orthodontic Resident Actions Prior to Starting Residency and Plans Upon Graduation of Residency

	Number (%)
Years before starting orthodontic residency (N=101)	
Immediately started residency	52 (51.5)
1-2 years	21 (20.8)
3-5 years	21 (20.8)
5+ years	7 (6.9)
Actions before entering orthodontic residency* (N=93)	
Immediately entered residency	54 (58.1)
Served in the military	7 (7.5)
Worked as an associate/ employee dentist	26 (28.0)
Owned a dental clinic	4 (4.3)
Worked in academia	2 (2.1)
Anticipated actions after orthodontic residency* (N=93)	
Work at a general or pediatric office	14 (15.1)
Buy an existing orthodontic practice	17 (18.3)
Start an orthodontic practice	13 (14.0)
Military	2 (2.1)
Academia/ teaching	6 (6.5)
Work at a private orthodontic practice	74 (80.0)
Work at a corporate orthodontic practice	29 (31.2)
Undecided	10 (10.1)
Other	1 (1.1)
Anticipated time to pay off student debt (N=97)	
Less than 2 years	17 (17.5)
2-5 years	13 (13.4)
5-10 years	27 (27.8)
10-15 years	18 (18.6)
15-20 years	10 (10.3)
20+ years	12 (12.4)

***Residents were able to select more than one answer**

3.2 Debt

The survey collected three metrics to measure orthodontic resident debt levels: anticipated debt upon graduation of orthodontic residency, debt upon graduation of dental school, and non-educational related debt (Table 4). The highest anticipated debt upon graduation was \$1,000,000 with the mean being \$403,520. The mean debt upon graduation from dental school was \$257,525. There was a strong positive correlation found ($r = .87$, $p < .001$) between anticipated debt upon graduation of orthodontic residency and total debt upon graduation of dental school (Figure 1). There was no correlation found between anticipated debt upon graduation of orthodontic residency and non-educational related debt ($r=.05$).

Table 4: Orthodontic Resident Debt Metrics						
	N	Minimum	Maximum	Mean	Std Deviation	Median
Anticipated debt upon graduation of orthodontic residency	98	\$0	\$1,000,000	\$403,520	\$289,064	\$377,500
Debt upon graduation of dental school	97	\$0	\$690,000	\$257,525	\$195,268	\$270,000
Non-educational related debt	96	\$0	\$560,000	\$41,458	\$110,307	\$0

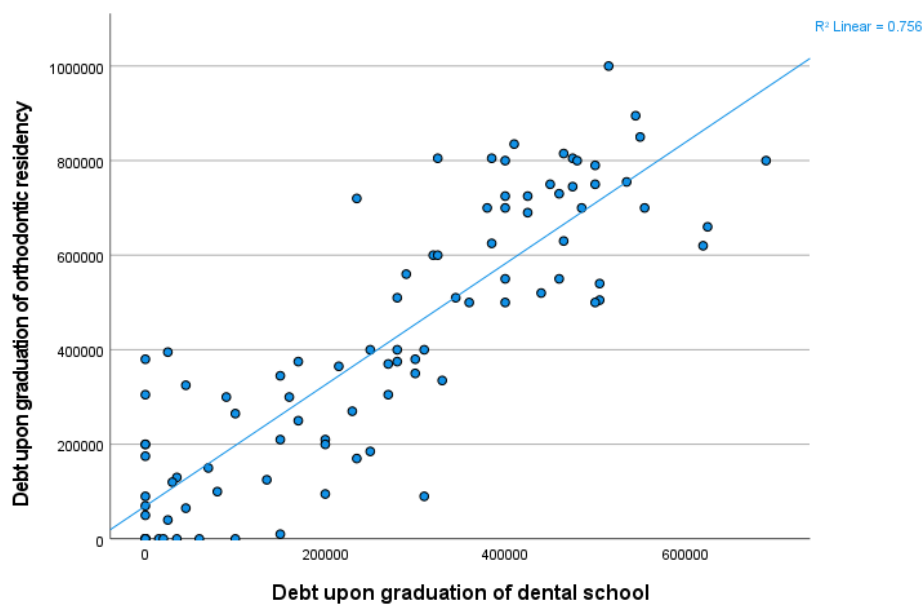


Figure 1: Anticipated debt upon graduation of orthodontic residency (\$) vs debt upon graduation of dental school (\$) ($r = .87$)

Residents were asked to estimate how long they anticipated it would take them to repay their loans (Figure 2). There was a statistically significant difference ($p < .001$) in debt levels found between the groups, as residents who felt it would take longer to repay their debt, also had higher anticipated debt levels at graduation from orthodontic residency.

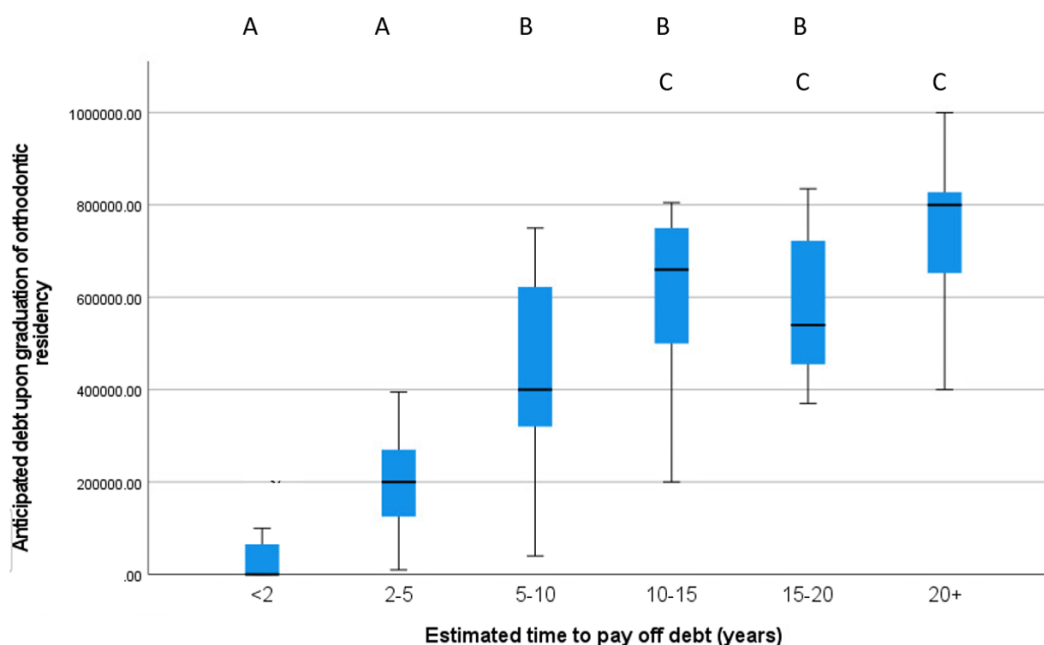


Figure 2: Anticipated length of time to completely repay student loans (years) vs anticipated debt upon graduation of orthodontic residency (\$). Different letters indicate a statistically significant difference in debt level between groups ($p < .001$)

3.3 Variables of Interest

In addition to debt, the other variables of interest included stress, attitudes towards debt (tolerant attitudes towards debt, knowledge and contemplation about loans, fear of debt), financial literacy and math anxiety. The results of these sections are detailed in Table 5. Correlational analysis was performed between the variables of interest. These correlations are illustrated in Table 6.

Table 5: Variables of Interest

	N	Minimum	Maximum	Mean	Standard Deviation	Median
Stress (0-40)	96	0	40	16.9	8.2	18.0
Tolerant attitudes towards debt (4-20)	99	4	20	10.2	3.8	10.0
Knowledge and contemplation about loans (4-20)	99	4	20	13.0	3.7	14.0
Fear of debt (3-15)	99	3	13	6.8	2.6	6.0
Financial literacy (0-5)	94	0	5	2.8	1.5	3.0
Math anxiety (1-10)	91	1	10	4.7	3.0	4.5

Table 6: Correlations Between Variables of Interest[†]

	Anticipated debt upon graduation of orthodontic residency	Stress	Tolerant attitudes towards debt	Knowledge and contemplation about loans	Fear of debt	Financial literacy	Math anxiety
Anticipated debt upon graduation of orthodontic residency	-	-	-	-	-	-	-
Stress	<i>0.51**</i>	-	-	-	-	-	-
Tolerant attitudes towards debt	<i>-.01</i>	<i>.48**</i>	-	-	-	-	-
Knowledge and contemplation about loans	<i>-.31**</i>	<i>.33**</i>	<i>.44**</i>	-	-	-	-
Fear of debt	<i>-.55**</i>	<i>.13</i>	<i>.49**</i>	<i>.59**</i>	-	-	-
Financial literacy	<i>-.07</i>	<i>.23*</i>	<i>.22*</i>	<i>.55**</i>	<i>.39**</i>	-	-
Math anxiety	<i>.191</i>	<i>.653**</i>	<i>.199</i>	<i>-.232*</i>	<i>-.217*</i>	<i>-.375**</i>	-

**** correlation is significant at the $p < .01$ level**

*** correlation is significant at the $p < .05$ level**

[†]A full list of correlations between variables is found in Table 8 (Appendix 1)

3.4 Stress

Table 5 shows that the mean perceived stress scale score was 16.9 (± 8.2) with the median score being 18.0. Table 6 shows that there was a moderate positive correlation ($r=.51$, $p<.001$) between perceived stress and total anticipated debt upon graduation of orthodontic residency (Figure 3). This supports the primary hypothesis (1) that increased debt upon graduation of orthodontic residency is correlated with an increased level of stress.

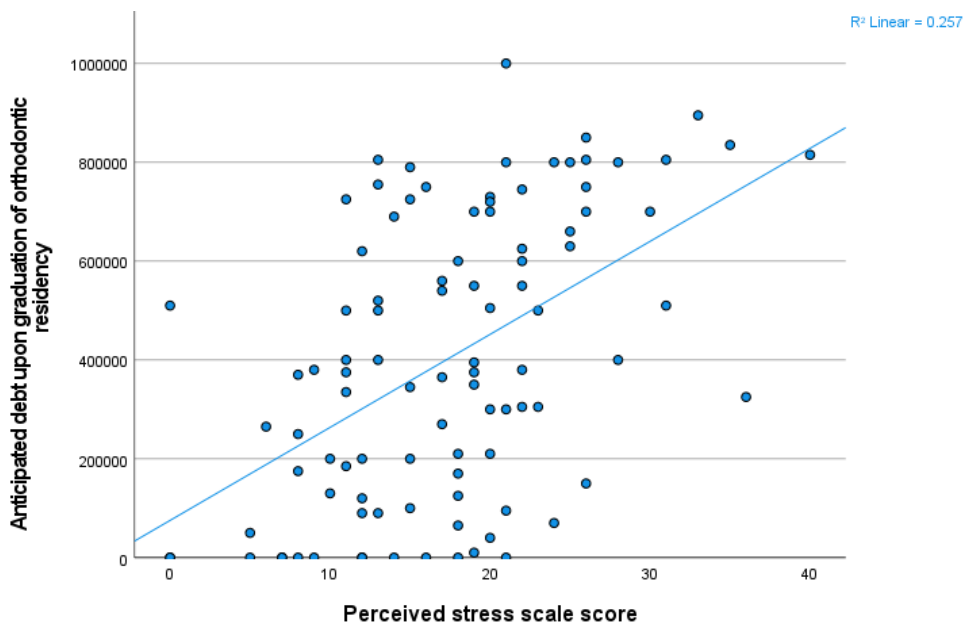


Figure 3: Anticipated debt upon graduation of orthodontic residency (\$) vs perceived stress scale score ($r=.51$)

3.5 Attitudes Towards Debt

Attitudes towards debt was split into three sections: tolerant attitudes towards debt, knowledge and contemplation about loans, and fear of debt.

Table 5 shows that the mean tolerant attitudes towards debt score was 10.2 (\pm 3.8) with the median score being 10.0. Table 6 shows there is no association between tolerant attitudes towards debt and total anticipated debt upon graduation of orthodontic residency ($r=.01$, $p=.92$). This refutes the secondary hypothesis (2) that higher total anticipated debt upon graduation of orthodontic residency is associated with increased tolerant attitudes towards debt.

Table 5 shows that the mean knowledge and contemplation about loans score was 13.0 (\pm 3.7) with the median score being 14.0. Table 6 shows a weak negative correlation ($r=-.31$, $p<.001$) between knowledge and contemplation about loans and total anticipated debt upon graduation of orthodontic residency (Figure 4). This supports the secondary hypothesis (3) that increased debt upon graduation of orthodontic residency is associated with lower knowledge and contemplation about loans.

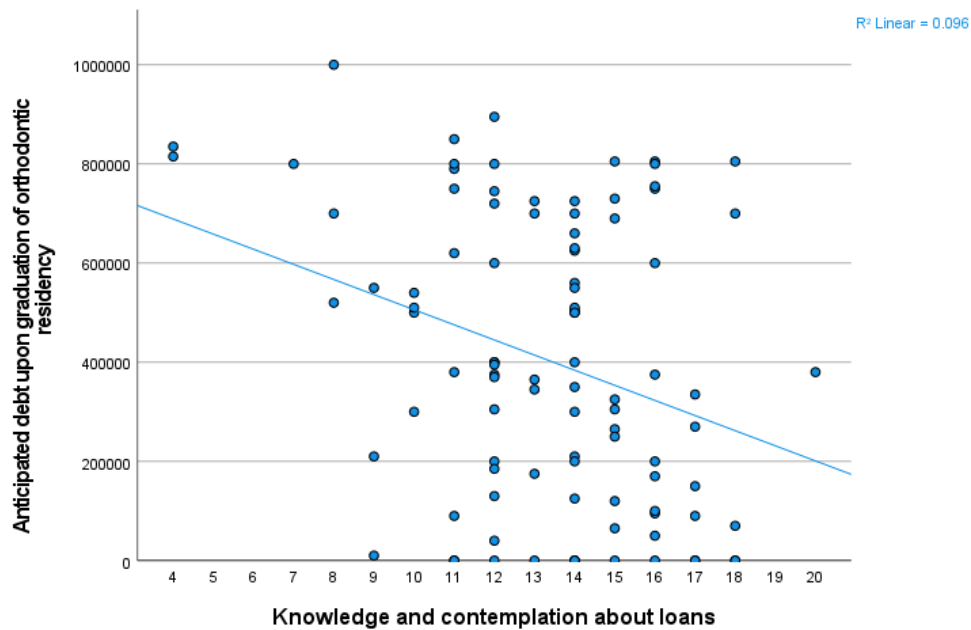


Figure 4: Anticipated debt upon graduation of orthodontic residency (\$) vs knowledge and contemplation about loans ($r=-.31$)

Table 5 shows that the mean fear of debt score was 6.8 (± 2.6) with the median score being 6.0. Table 6 shows there was a moderate negative correlation ($r=-.55$, $p<.001$) between fear of debt and anticipated debt upon graduation of orthodontic residency (Figure 5). This supports the secondary hypothesis (4) that increased fear of debt is associated with increased levels of anticipated debt upon graduation of orthodontic residency.

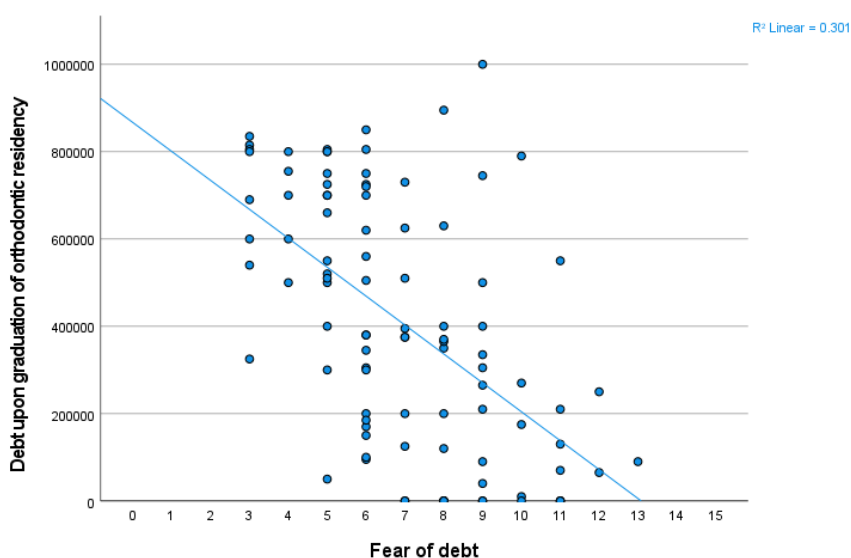


Figure 5: Anticipated debt upon graduation of orthodontic residency (\$) vs fear of debt ($r=-.55$)

3.6 Financial Literacy

Table 5 shows that the mean financial literacy score was 2.8 (± 1.5) with the median score being 3.0. Table 6 shows no correlation between anticipated debt upon graduation of orthodontic residency and financial literacy ($r=-.07$, $p=.48$). This refutes the secondary hypothesis (5) that increased debt upon graduation of orthodontic residency is associated with decreased financial literacy.

3.7 Math Anxiety

Table 5 shows that the mean math anxiety score was 4.7 (± 3.0) with the median score being 4.5. Table 6 shows no correlation between anticipated debt upon graduation of orthodontic residency and math anxiety ($r=.19$, $p=.07$). This refutes the secondary

hypothesis (6) that increased debt upon graduation of orthodontic residency is associated with increased math anxiety.

3.8 Other Findings Not Pertaining to Hypothesis

The survey showed some interesting findings that weren't directly related to answering the hypotheses, but are worth mentioning.

Table 8 (Appendix 1) shows that a moderate correlation ($r = .65$, $p < .001$) was found between math anxiety and perceived stress scale score (Figure 6).

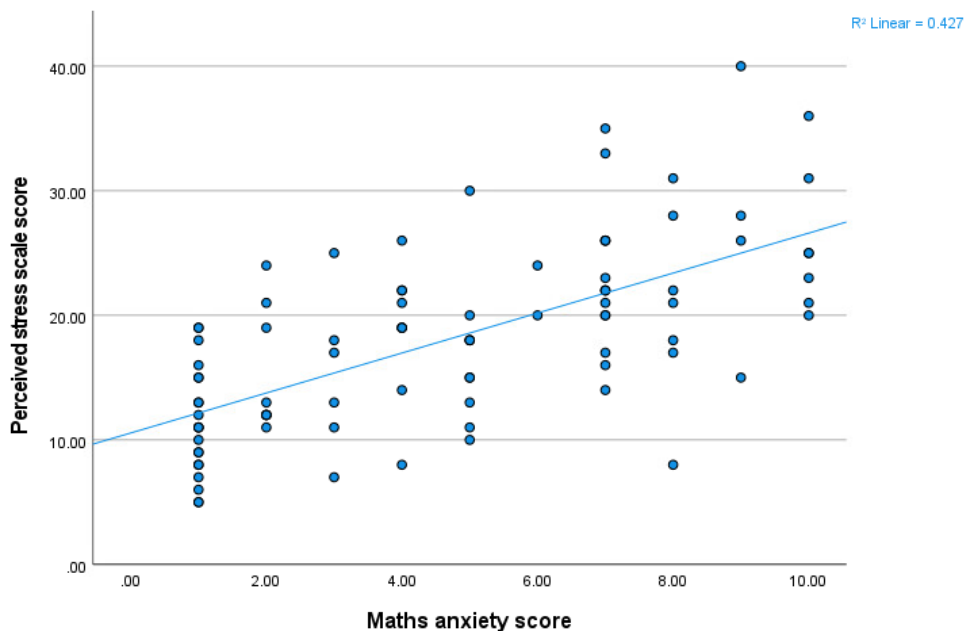


Figure 6: Math anxiety scale score vs perceived stress scale score ($r = .65$)

Respondents were asked explicitly whether their debt was causing them anxiety. Residents were asked the question “is the debt you are accruing a source of anxiety in your life?”. Responses ranged from “No, not at all” to “Yes, a large amount”. The results

showed that as anxiety level from debt increased, the mean anticipated debt upon graduation of orthodontic residency increased as well (Figure 7). A statistically significant difference ($p<.001$) was found between the groups.

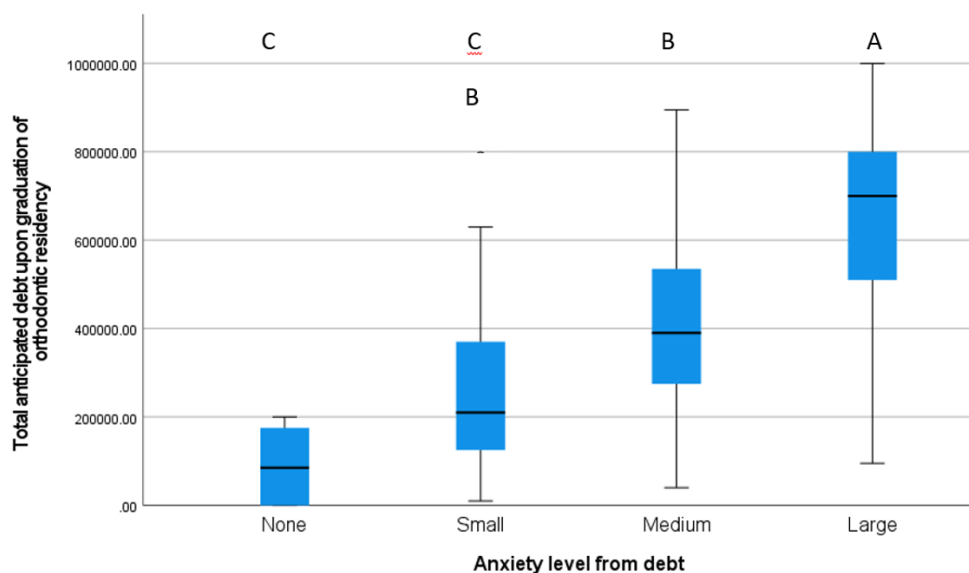


Figure 7: Anxiety level from debt vs anticipated debt level upon graduation of orthodontic residency (\$). Letters indicate a statistically significant difference ($p<.001$)

Table 8 (Appendix 1) shows there was a weak negative correlation ($r=-.29$, $p<.001$) found between anticipated debt upon graduation of orthodontic residency and yearly stipend of residency program. In addition, Table 8 (Appendix 1) shows there was a moderate positive correlation ($r=.51$, $p<.001$) found between anticipated debt upon graduation of orthodontic residency and yearly tuition of residency program.

Residents were asked how many years they waited between finishing dental school and starting orthodontic residency. There was a statistically significant difference ($p=.03$) in mean anticipated debt level upon graduation of orthodontic residency between those who

started residency less than one year out of dental school and those who waited three years or more before starting residency (Figure 8).

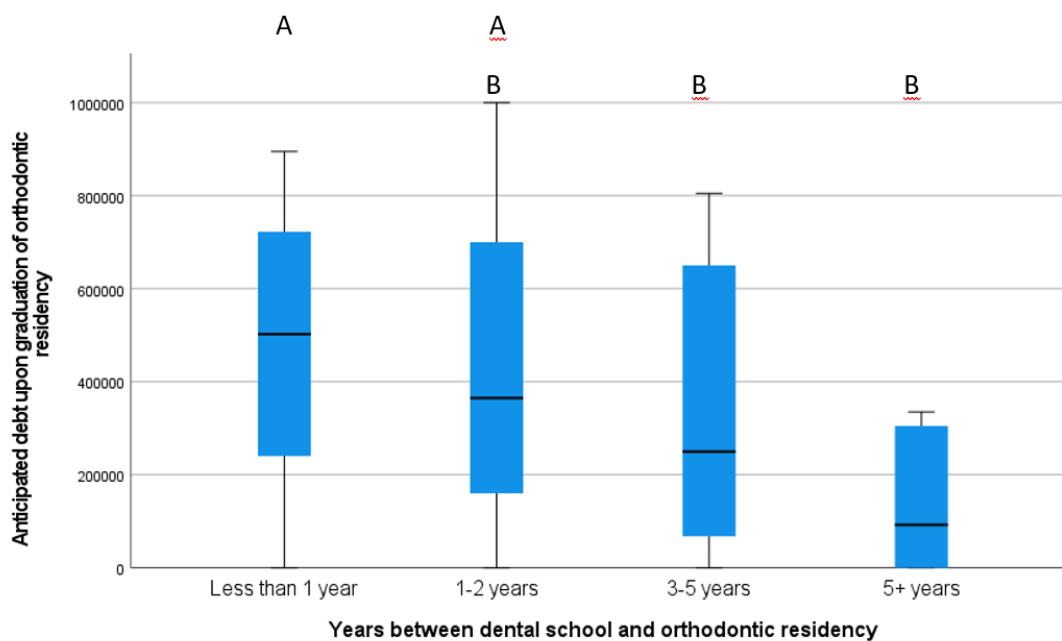


Figure 8: Time between finishing dental school and starting orthodontic residency vs anticipated debt upon graduation of orthodontic residency (\$). Different letters indicate a statistically significant difference between groups (p=.03)

The anticipated debt upon graduation of orthodontic residency was broken down by residency year (Figure 9). There was no statistically significant difference between year of residency and anticipated debt upon graduation of orthodontic residency (p=.11).

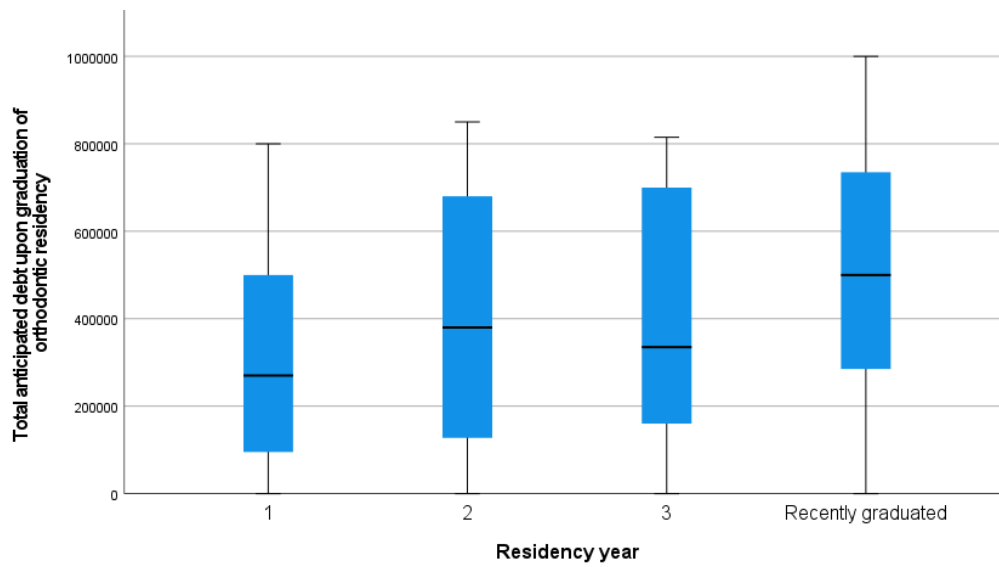


Figure 9: Anticipated debt upon graduation of orthodontic residency (\$) vs residency year (p=.11)

Table 6 shows some other correlations that were found between the variables of interest that were not related to the hypothesis. It shows a moderate positive correlation between knowledge and contemplation about loans and fear of debt ($r = .59, p < .001$), and between knowledge and contemplation about loans and financial literacy ($r = .55, p < .001$).

Chapter 4

4 Discussion

An increase in educational costs over recent years has led to an increase of debt amongst orthodontic residents. There is little data available on the cause of debt acquisition amongst orthodontists, and whether this higher level of debt is associated with higher levels of stress. Thus, the aim of this study was to determine whether there are any associations between an orthodontic residents' debt level and their stress level, attitudes towards debt, financial literacy and math anxiety. The survey was distributed to 1178 orthodontic residents and recent graduates, and received 101 responses which were included in the results.

4.1 Survey Design

Funkhouser et al⁶³ found that the response rate of a survey is generally a good indicator of its quality. Response rates are generally lower for healthcare professionals in comparison to the general public. This is perhaps a result of perceived lack of importance, lack of time, concerns about the bias of the survey, concerns about confidentiality, and “gate keeper” office personnel who screen email and mail requests.⁶³

Kaplowitz et al⁶⁴ found that email based surveys generally had a lower response rate than mail based surveys. This survey was distributed by email as it was deemed to be the most efficient way to distribute a survey during the global pandemic resulting from COVID-19. The anticipated response rate of email based surveys is 20.7%.³⁹ This survey was distributed to 1178 and had 101 responses for a response rate of 8.57%. This could be regarded as a low response rate, however, Groves et al³⁹ showed that bias introduced by non-responses is relatively small. The response rate was deemed sufficient to give an insight into the possible relationships between an orthodontics residents debt level and various factors.

The lower response rate may have been a result of the nature of the questionnaire. Residents may have felt that discussing their financial situation was a sensitive topic and thus they may have been reluctant to divulge such personal information. Possible factors that could have increased the survey response rate include a second reminder email to participate in the survey, and the introduction of a direct financial reward to participants who completed the survey.

It is possible that there existed bias within the respondents of the survey. Orthodontic residents who are concerned about their debt level may have been more inclined to respond to the survey. In an attempt to minimize the bias, the current study encouraged all residents to complete the survey irrespective of their debt level. The survey did receive 15 respondents who had no debt, possibly indicating a representative group of respondents.

4.2 Demographics

The survey collected data about the demographics of the respondents. Currently, the most recent survey of orthodontic residents was done by Stoker et al¹² who surveyed 369 orthodontic residents at the 2018 Graduate Orthodontic Residency Program (GORP; results published in 2020). The AAO conducted an Orthodontic Resident Tracking Survey (2017)⁴ which received 119 responses. This study had a fewer number of responses than these surveys.

Individuals who responded to this survey were majority female (60.3%), single (48.5%), white (67.3%), American citizens (77.2%), with the majority (48.5%) being in the 28-30 age category. This is consistent with results by Stoker et al¹² who found the majority of residents to be female (51%), single (63%), white (60%), American citizens (85%) with the majority (47%) being in the 27-29 age category.

The majority of respondents in this study (51%) reported immediately entering orthodontic residency after dental school. This is supported by research performed by Stoker et al¹² that also found the majority of orthodontic residents (67%) immediately entered residency after dental school. Of the residents who did not immediately enter orthodontic residency after dental school, the majority (67%) reported working as an associate dentist. This is consistent with research performed by Stoker et al¹² who also found the majority (47%) of residents worked as an associate dentist before residency.

The current study had a cohort of respondents that was similar to larger studies on orthodontic residents reported in the literature. This is likely due to the fact that all residents in North America are strongly encouraged to sign up to be AAO members, and thus targeting members of the AAO resulted in a sample size that is an accurate reflection of the entire orthodontic resident cohort.

4.3 Debt

The current study aimed to record orthodontic residents' debt levels. This was achieved by asking orthodontic residents to anticipate their debt upon graduation of their orthodontic residency (for recent graduates they were asked what their debt level upon graduation was), as well as asking about their debt upon graduation of dental school, and their current non-educational debt level.

The current study found the mean total anticipated educational related debt upon graduation of orthodontic residency was \$403,520. A student debt of >250,000 is in the top 0.4% of educational debt in the US.⁵⁴ The mean debt upon graduation of dental school was \$257,525 per resident. Non-educational debt level was found to be an average of \$41,458 per resident. There was a strong positive correlation found ($r = .87$) between anticipated debt upon graduation of orthodontic residency and debt upon graduation of dental school. This suggests that a resident with a higher debt level upon graduation of dental school is likely to have a higher debt level upon graduation of orthodontic

residency. This is likely due to the fact that total debt upon graduation of dental school comprises a large portion of the debt upon graduation of orthodontic residency. There was no correlation found between anticipated debt upon graduation of orthodontic residency and non-educational related debt. This suggests that residents with higher anticipated debt upon graduation of orthodontic residency are not more likely to have higher levels of non-educational related debt. As such, residents with higher educational related debt likely do not have an appetite for increased debt in general.

There have been three studies on the amount of debt amongst orthodontic residents. Stoker et al¹² (2020) found estimated orthodontic and total educational debt averaged \$137,706 and \$323,071, respectively. Pruzansky et al¹¹ found that 44.4% of orthodontic residents had a total loan debt of over \$200,000. They did not report specific data on the amount of debt other than it was at least \$200,000. They also did not specify the source of this loan debt – ie whether it was educational or non-educational in nature. A 2018 survey by the American Association of Orthodontists found the average educational related debt of an orthodontist graduating is \$428,150, with 26% of orthodontists expecting to have \$600,000 or more in debt by the time of graduation⁴. The current study found the debt levels of orthodontic residents to be in line with previous literature.

Residents were asked how long they anticipate it will take to repay their loans. Using these averages, the mean yearly amount residents are required to repay to completely eliminate their debt in the anticipated timeframe can be calculated (Table 7).

Table 7: Average Yearly Repayment Required to Completely Repay Loans

	N	Mean anticipated debt (\$)	Mean anticipated time to repay debt (years)	2019 Federal interest rate (USA)	Calculated average yearly repayment required (\$)
Residents who reported anticipated debt >0	85	459,825	10.9	7.6%	62,172

The current study found that, on average, residents plan to repay their debt at a rate of \$62,172 per year. This debt must be repaid with after tax money. The average salary of an orthodontist in the US in 2018 was \$229,000 which is roughly \$145,000 after tax dollars (variable by the state).¹² Thus, residents anticipate committing close to 50% of their net salary to repay their loans. In a 2016 report on Household Risk Assessment, a Debt to Service Ratio (DSR) of 35 per cent was identified as a critical threshold, above which there is a significant increase in households' propensity to be delinquent on their mortgages.⁶⁷ Dey et al⁶⁸ found only 5.7% of households aged between 25-34 years old had Debt to Service Ratios above 40%. It must be noted that these numbers include household income (i.e. 2 earners) and include the home mortgage. Thus, for orthodontic residents to repay their debt at their estimated rates they would be regarded as a high risk category before they even service a home mortgage. This suggests that residents may be overestimating their ability to repay debt.

4.4 Stress

The current survey aimed to determine whether there was a correlation between an orthodontic resident's anticipated debt level upon graduation and perceived stress levels. The current study found a moderate positive correlation ($r=0.51$) between the two variables. This supported the primary hypothesis that an orthodontists anticipated debt level upon graduation is correlated to their stress level.

There are many deleterious effects of stress. Higher perceived stress scale scores have been shown to be associated with failure to quit smoking, failure among diabetics to control blood sugar levels, greater vulnerability to stressful life-event-elicited depressive symptoms, and more colds²³. Debt stress is a catalyst for "stress proliferation" in which one stressor leads to the formation of multiple others. Higher levels of debt may also contribute to negative health outcomes, including higher diastolic blood pressure, obesity, poor mental health, as well as poor general health.²³ Systematic reviews performed by Richardson et al⁶⁹ showed associations between higher levels of debt and various mental health and substance abuse problems for doctors. Rohlfing⁷⁰ found student loan debt has been linked to stress, burnout, and suicidal thoughts among medical trainees (eg, students and/or residents). In addition, Cooke et al⁷¹ and colleagues concluded that undergraduate students with higher debt felt more tense, criticized by others, unhappy, and irritable than students with less or no debt. Individuals with considerable student loan debt are at increased risk for greater stress and decreased "psychological functioning," as noted by Heckman and colleagues⁷², and Walsemann and colleagues⁷³.

It must be noted that correlation doesn't necessarily equate to causation. However, it is reasonable to assume that students with higher debt levels are more stressed and anxious at the thought of repaying their loans. This is supported by research performed by Stoker et al¹² that found that higher debts levels caused residents more anxiety. This is further supported by the current study's global question asking "are your student loans a source of anxiety in your life" which showed a significant difference in debt levels between the groups who answered "no, not at all" in comparison to the group answering "yes, a large

amount". Stoker et al¹² found 72% of respondents expressed varying levels (mild, moderate, or major) of anxiety because of their student debt. Higher amounts of both orthodontic and total educational debts were significantly associated with higher levels of anxiety.

In addition, Boyles¹⁰ showed student debt amongst dentists affected student stress levels, with individuals with greater debt levels exhibiting greater stress and concern regarding paying off their student loans. Pisaniello et al¹⁶ performed a systematic review amongst stress and debt amongst medical residents and found that reported levels of financial stress were high among medical students, and correlated with educational debt. Thus, while this study did not find a direct causal relationship between debt and stress, there is a logical justification as to why increased debt may cause increased stress.

Consequently, the results of this study should not be taken lightly. Orthodontic residents are being burdened with historic levels of debt which has been shown to have a positive correlation with their stress level. The negative effects this stress has on the new generation of orthodontists is unknown at this time and further research in the area is needed.

The present study found the mean perceived stress score to be 16.9. This can be compared to the general population (2,387 respondents in the United States aged 18-65+) which found a mean perceived stress scale score of 13.1(\pm 6.3).⁶² Thus, orthodontic residents were found to have a higher stress level than the general population. However this level was within one standard deviation of the average population. This could be a result of various factors. The stressful aspects of dentistry as a career have been well researched. Potential effects of high levels of occupational stress in dentistry have been found to include hypertension, coronary artery disease, and suicide.⁷⁴ Almost one-quarter of the dentists who chose to leave the profession reported stress or burnout as their main reason for changing careers.⁷⁴ Thus, dentistry is considered a stressful profession. While orthodontics is a somewhat different career path to dentistry, there are many aspects which are similar stressors. Roth et al⁷⁴ found the three most highly scored stressors

amongst orthodontists were: the patient shows dissatisfaction with the care received, performing clinical tasks on a difficult or uncooperative patient, and falling behind schedule. They concluded that the stressors in orthodontic practice are similar to those in dentistry, but some stressors unique to the orthodontic profession do exist. These are issues that orthodontic residents are likely to be exposed to in residency and may be contributing to stress levels in orthodontic residents being higher than the general population. Future research in this area is needed.

The relationship between stress and orthodontic residents may be a result of the personality types that are attracted to orthodontics. Due to the competitive nature of orthodontic residencies there is likely to be a higher proportion of Type A personalities, which has a significant correlation with academic achievement.¹² Type A personality is characterized by higher stress levels.¹² Consequently, the higher stress levels of orthodontic residents may possibly be confounded by the personality types of the residents rather than a result of the profession.

4.5 Attitudes Towards Debt

The current study aimed to measure correlations between orthodontic residents' attitudes towards debt and their debt level. This was achieved by measuring orthodontic residents' tolerant attitudes towards debt, knowledge and contemplation about loans, and fear of debt.

4.5.1 Tolerant Attitudes Towards Debt

The current study found no correlation between attitudes towards debt and educational related debt level. This refuted the secondary hypothesis that orthodontic residents with higher tolerant attitudes towards debt have a higher anticipated debt upon graduation of orthodontic residency. This is consistent with previous literature. Chisholm-Burns et al⁶

found no correlation between tolerant attitudes towards debt and debt level amongst pharmacy students.

This suggests that orthodontic residents with higher levels of debt are not more tolerant to debt than their peers with lower levels of debt. Consequently, there are other factors at play which dictate orthodontic residents' choice to amass debt. The current survey found that debt levels are correlated with stipend, yearly tuition, and debt from dental school (Table 8, Appendix 1). This shows that the debt level of orthodontists is more likely a function of the cost associated with their dental school and orthodontic residency rather than their tolerance for debt. This is also supported by research by Stoker et al¹² that found estimated total educational debt was correlated to orthodontic debt ($r = 0.70$) and significantly lower for respondents with stipends.

The current study found the mean tolerant attitudes towards debt score to be 10.2. This can be compared to pharmacy students in which the mean tolerant attitudes towards debt was found to be $8.83(\pm 2.46)$.⁶ Thus, orthodontic residents were found to have higher tolerant attitudes towards debt in comparison to pharmacy students but this score was within one standard deviation. The discrepancy may arise from the fact that orthodontic residents (\$403,520) are, on average, facing higher levels of student debt and longer training than pharmacists (\$153,033)⁶ and more tolerant to the idea of taking on debt.

4.5.2 Knowledge and Contemplation about loans

The current study found a weak negative correlation ($r = -0.31$) between knowledge and contemplation about loans and anticipated debt upon graduation of orthodontic residency. This partially supports the secondary hypothesis that orthodontic residents with higher knowledge and contemplation about loans have lower anticipated debt upon graduation of orthodontic residency. This suggests that residents who were more thoughtful and knowledgeable about loans accumulated less debt. This is consistent with previous

literature performed by Chisholm-Burns et al⁶ who found pharmacy students with higher knowledge and contemplation about loans scores accumulated less debt.

A correlation is not causation, however, there certainly is a reasonable justification as to why students with more knowledge and thoughtfulness about their loans can have reduced student loan levels. Those residents who are more thoughtful about their loans can minimize the amount they borrow consequently minimizing their debt level. This is supported by the findings of Norvilitis and colleagues⁷⁵, who found that increased financial knowledge resulted in less debt among college students.

This raises an interesting thought – that perhaps educating pre-dental students, or dental students applying to orthodontic residencies, so that they are more knowledgeable about student loans, may enable them to reduce their student debt through their path to becoming an orthodontist. Future research in this area would be interesting to determine if there is a causal relationship.

The current study found the mean knowledge and contemplation about loans score to be 13.0 amongst orthodontic residents which is similar to 13.9(\pm 2.6) found amongst pharmacy students. Orthodontic residents (\$403,520) are, on average, amassing higher levels of student debt than pharmacists (\$153,033)⁶. This discrepancy may further support the notion that knowledge and contemplation about loans doesn't have a large effect debt level.

4.5.3 Fear of Debt

The current study found a moderate negative correlation ($r=-0.55$) between fear of debt and educational related debt level. A resident with a higher fear of debt score (indicating less fear of debt) had less debt. Consequently, residents with higher debt levels had a higher fear of debt. This supports the secondary hypothesis that orthodontic residents

with a higher fear of debt have a higher anticipated debt upon graduation of orthodontic residency.

This is consistent with previous literature. Chisholm-Burns et al⁶ found that pharmacy students with higher debt levels also exhibited greater fear of debt. It is reasonable to assume students with higher debt levels are concerned, anxious, or fearful at the prospect of repaying loans, which likely explains the correlation between the “fear of debt” subscale and student loan amounts. This study found debt levels amongst orthodontic residents ranged all the way up to one million dollars. This is a significant debt load that may take a lifetime to repay. Thus, it is logical that individuals with higher debt levels are more fearful of their debt.

However, this does raise an interesting point. Orthodontic residents are voluntarily accepting these loans. It shows that if they are in fact more fearful of high levels of debt, but still voluntarily accepting these high levels of debt, that there must be stronger factors at play. Noble et al⁶¹ found that the decision to become an orthodontist is largely made early in life, before dental school, and a passion for orthodontics is the main motivating factor. Stoker et al¹² found that a passion for orthodontics was the most important factor when choosing a career in orthodontics. Thus, orthodontic residents have a strong drive to become orthodontists and it is reasonable to assume that their passion to become an orthodontist is overriding their fear of debt.

In addition, the current study has shown that the total cost of dental school, yearly tuition of orthodontic residency, and stipend of orthodontic residency are all correlated to total estimated debt upon graduation of orthodontic residency. Thus, an orthodontist can reduce their educational debt load by attending a dental school and orthodontic program with lower tuition, and preferably an orthodontic residency that pays a stipend. However, due to the competitive nature of the specialty many orthodontic residents may not have much of a choice in where they attend. The National Match Service⁷⁶, which matches the majority of dentists to specialty programs, releases their statistics every year. The 2020 results showed that there were 502 applicants for 318 orthodontic residency places,

illustrating the competitive nature of the specialty (the number of applicants is indicative of the number of applicants who received an interview and thus the number of applicants is higher when those who did not receive an interview are factored in). As a result, orthodontic residents may not have the luxury of choosing the specialty program they are accepted into.

The current study found the mean fear of debt score to be 6.8. This compares to 7.5(± 2.4) found amongst pharmacy students. This study shows that orthodontic residents have a higher fear of debt than pharmacy students. Orthodontic residents (\$403,520) are, on average, amassing higher levels of student debt than pharmacists (\$153,033)⁶. This further supports the notion that higher debt levels are associated with increased fear of debt.

4.6 Financial Literacy

The current study aimed to determine if there was a relationship between orthodontic residents' debt levels and their financial literacy. No relationship was found between these variables. This refutes the secondary hypothesis that orthodontic residents with a higher level of financial literacy have lower anticipated debt upon graduation from orthodontic residency.

This provides evidence that the decision to amass record levels of debt is not related to poor financial literacy of orthodontic residents but is under the influence of other stronger factors. Stoker et al¹² found the factor that was most important for choosing a career in orthodontics was passion for orthodontics (41%), followed closely by workload flexibility and predictability (35%). Stoker et al¹² also found that clinical education was most frequently rated as the most important factor when choosing an orthodontic residency. Location was ranked second, followed by cost. Thus, it is likely that orthodontic resident's decision to amass large levels of debt is more likely based on their passion to become an orthodontist at any cost, and is unrelated to their financial literacy.

The study showed a moderate positive correlation between financial literacy and knowledge and contemplation about loans ($r=0.55$). Research has shown that the effect of financial literacy is strongly correlated with behavior that is indicative of financial capability.³⁵ Thus, it is reasonable to assume that those residents with higher financial literacy exhibit more financial capability, which includes understanding their loans. In addition, studies show high levels of financial literacy are correlated with less expensive borrowing and debt management.⁵³ This is a likely explanation as to why the present study found orthodontic residents with higher levels of financial literacy exhibit more knowledge and contemplation before undertaking their loans for school.

4.7 Math Anxiety

The current study found no correlation between math anxiety and anticipated debt upon graduation of orthodontic residency. This refutes the secondary hypothesis that orthodontic residents with a higher level of math anxiety have a higher level of anticipated debt upon graduation of orthodontic residency.

The current study found the mean score for math anxiety amongst orthodontic residents to be 4.7. Núñez-Peña et al⁶⁰ found the mean math anxiety score of first- and second-year psychology students (University of Barcelona) to be 5.18 (± 2.43). Thus, orthodontic residents were found to have slightly lower math anxiety scores than other university students. Due to the highly competitive nature of dental school and orthodontic residency, orthodontic residents are more likely to have been high achievers in high school and university and thus more likely to be proficient at math, thus lowering their math anxiety score, as higher math anxiety has been linked to poorer math performance.⁶⁰

The current study found a moderate positive correlation ($r=.65$) between math anxiety and perceived stress scale score. Previous studies have shown moderate correlations have been observed between general anxiety and math anxiety.⁷⁸ It is likely that orthodontic residents who exhibited higher levels of math anxiety are overall more anxious in

general, thus increasing their general stress levels. Several studies suggest that mathematics anxiety is more closely related to other measures of anxiety than to measures of academic ability and performance.⁷⁸

4.8 Market Bubble

Stoker et al¹² discussed the risk on an orthodontic education reaching a “bubble market”. Orthodontic residents are buying an education which allows them to practice as an orthodontist. If the financial benefit (future salary as an orthodontist) does not outweigh the cost of orthodontic residency, then professional education risks becoming a “bubble market”. Orthodontic residents learn skills in residency that are then sold to patients in the form of services. As long as it is believed that patients will keep paying more and more for orthodontic services, students should be willing to pay more for the education that enables them to sell those services. Schools can sustain their high tuitions only if students can be convinced of higher returns in the form of payments from future patients. Therefore, the amount that schools are able to charge students is linked to how much we pay orthodontists now and how much we plan to pay them in the future.

The educational bubble market in the United States has been assessed for a number of professional degrees.¹² This is done by using the ratio of average total educational debt to average annual income on entry into the professional workforce. Values for this ratio for health professionals include 0.83 for family medicine, 0.98 for dentistry, 1.30 for optometry, and 1.62 for veterinary medicine. There is no specific debt-to-income ratio that defines a bubble market but veterinarians are deemed as nearing one.¹² Chisholm-Burns et al⁷⁹ also looked at debt to income ratio of various health professions and found that in comparison to pharmacists, optometrists, family physicians and veterinarians, dentists experienced the worst change in income to debt ratio between 2006 and 2016. This is due to decreasing income levels and increasing student loan balances.⁷⁹ The present study found average debt to be \$403,520, and with wage data from the U.S.

Bureau of Labor Statistics showing that the mean annual wage of orthodontists was \$229,000 for 2018,¹² the ratio for orthodontists is 1.76. Even though this calculation does not account for lost income while in residency or a likely lower entry level salary for new orthodontists, it still indicates that orthodontic residency may be approaching a “bubble market”.

One major factor that may be driving the bubble market and orthodontic residents’ appetite for massive levels of debt may be due to their unrealistic salary expectations. Research has shown orthodontic graduates’ expectations of their earning potential may be overly ambitious, and not rational in the current economy.¹² This may also account for the ambitious loan repayment rates estimated by residents. In addition, Pruzansky et al¹¹ found that 80% of respondents reported difficulty in finding their first jobs, 77% were unable to afford to purchase homes or save for retirement, 71% were unable to afford to purchase practices, and 67% found that debt influenced their decisions to associate rather than own their own practices. Consequently, orthodontic residents may be willing to amass such large levels of debt because they have unrealistic salary expectations and are overestimating their ability to repay debt.

4.9 Limitations of Study

There are various limitations associated with this study that may have influenced the results. Some of the major limitations include the survey being voluntary, estimating debt upon graduation of orthodontic residency, correlation vs causation and sample size.

4.9.1 Voluntary Survey

One limitation of the study was the fact that the survey was voluntary, possibly introducing selection bias or non-participation bias. Students who may not feel comfortable discussing their debt would be deterred from completing the survey. However, the survey did receive a balanced sample size of residents with high debt levels

and low debt levels, suggesting selection bias of this variable may not have had a large influence on the responses. In addition, for those residents who decided to start the survey, the survey needed to be designed in a way that did not deter participation. This involved keeping the survey relatively quick to complete. This resulted in having to create questions that weren't too complex or time consuming. This was particularly constraining during the financial literacy section. Previous literature by Walton et al³³ found that Canadian dental students consistently underestimated the total cost of dental school, and this may be a result of students underestimating the effects of compounding interest and yearly tuition increases of their education. However, to effectively analyze this would have required complex time-consuming financial questions. This would be an interesting area for future research.

4.9.2 Estimating Debt Upon Graduation of Orthodontic Residency

Another limitation of this study was that students had to estimate their debt upon graduation. This is potentially fraught with errors as there is inherently no way to very accurately predict one's financial position in the future. Thus, the data is based off estimates. One would assume that those residents who were further into their orthodontic residency would be able to more accurately estimate their debt upon graduation for a few reasons. Firstly, they are closer to graduation and thus there is a smaller margin of error in their estimation. Secondly, they would have a more accurate idea of their costs throughout residency so far and would be able to extrapolate more accurately. Lastly, as residents approach graduation, they may start to familiarize themselves with the repayment terms of their loans, and therefore become more aware of their debt upon graduation. While recent graduates did report higher levels of anticipated debt upon graduation than 1st, 2nd, and 3rd year residents, there was no statistically significant difference between the groups. An interesting area for future research would be to complete the current survey but only distribute it to respondents who had graduated and knew their exact debt level upon graduation.

4.9.3 Correlation vs Causation

Due to the cross sectional nature of the survey, the results could only indicate whether a correlation existed between the variables, which of course does not necessarily equate to causation. This study does provide correlations with plausible explanations as to why these relationships may in fact be causal in nature. However, the results cannot be interpreted to represent a causal relationship between the variables. This study provides a platform for further research into the area to determine whether the relationships are actually causal in nature.

4.9.4 Sample Size

The study did receive a low level of responses when compared to the total number of orthodontic residents in North America. The survey had 101 responses which represents 8.6% of the 1178 current residents across North America. Consequently, the results obtained may not be representative of the larger population. However, the survey did find similar levels of debt per resident, and similar demographics, to a larger study performed by Stoker et al¹², which indicates that the sample size could potentially be reflective of the larger orthodontic resident population.

4.9.5 Covid-19

The survey was distributed to residents during the COVID-19 pandemic. Currently there is no data on how COVID has impacted the stress levels of orthodontic residents. The global COVID-19 pandemic may have influenced the results obtained in the current study, thus, it is a limitation of this research. However, the survey was distributed in October 2020, at a time when many schools and clinics had reopened after initial

closures, likely minimizing these effects, since residencies and practices were running close to normal by this stage. Further research into this area is needed.

4.10 Strengths of Study

There were various strengths associated with this study. The main strengths included the survey delivery being online, the use of sliding scales, inclusion of previously validated surveys, and generalizability.

4.10.1 Online Questionnaire

The survey utilized an online questionnaire. This was particularly effective given the current global COVID-19 pandemic. Previous surveys to residents, for example that performed by Stoker et al¹², relied on contacting residents at the annual Graduate Orthodontic Residency Program (GORP) student convention. GORP was cancelled in 2020 due to COVID-19, and thus it was a strength of this study that it did not rely on an event to contact participants. The online survey also allowed residents to sit in the privacy of their choosing to thoroughly answer the survey.

In addition, utilizing the AAO's Partners in Research program ensured that the survey was delivered to all current orthodontic residents who are AAO members in North America. While joining the AAO isn't mandatory, it is strongly encouraged and offered at heavily discounted rates during residency to promote membership. Thus, this allowed the survey to reach a very large proportion of orthodontic residents in North America minimizing selection bias within the survey.

4.10.2 Sliding Scales

The use of sliding scales for many of the questions allowed a more accurate way to collect data. The ability of residents to use a sliding scale was a particularly effective way for them to estimate their debt levels, and much more accurate than debt categories would have been. This was a limitation Stoker et al¹² noted in their study. In addition, they noted another limitation of their study in that their option for choosing length of orthodontic program is reported in a restricted way with choices grouped as 24 months, 25-30 months, and >31 months. They stated it would have been better to know the exact number of months, and gain a better understanding if the length of programs is increasing overall with time. In 2018-2019, the average length in months of U.S. orthodontic programs was 30.9. The current survey utilized a sliding scale which would potentially give a more accurate reading and found the mean program length to be 32.4 months. This possible increase of program length over time would be an interesting area for future research.

4.10.3 Validated Surveys

The current study utilized previously validated surveys. The use of validated surveys may have helped decrease bias that may arise in a questionnaire, and help increase reliability. The surveys used had already gone through the process of content, construct and criterion validity in populations similar to orthodontic residents, and have already been tested for an acceptable level of internal consistency.

Previous research performed on orthodontic residents' stress levels by Stoker et al¹² did not use a validated metric to measure stress, and rather asked residents to estimate their own anxiety level. This may have introduced errors as it is not a standardized measure. The current study utilized a validated metric to measure orthodontic residents' stress levels.⁶² In addition, the metric used to measure attitudes towards debt was a validated survey, which had been previously utilized on other types of health care professionals.³⁰

Furthermore, the financial literacy scale was based off of validated financial literacy metrics used extensively in the literature, and which had undergone meta-analysis.³⁵ The current study slightly modified the actual numbers used in the survey so that residents could not easily research the correct answers to the questions. Finally, the item used to measure math anxiety was the SIMA scale which is a validated, simple and quick scale used extensively in the literature.⁶⁰

4.10.4 Generalizability

The current study, while having a relatively small sample size, found similar results to other studies and is thus likely to be representative of the North American orthodontic resident population as a whole. The study found similar demographics to a larger study published by Stoker et al¹². In addition, the estimation of total debt upon graduation of orthodontic residency by residents were similar to a survey conducted by the American Association of Orthodontists in which recent graduates disclosed their actual debt upon graduation. In addition, the survey was distributed to all student members of the AAO, and while membership is not compulsory, it is strongly encouraged and offered at a heavily discounted rate for second and third year residents, and free for first year residents. Thus, the survey was distributed to a large proportion of orthodontic residents in North America increasing the likelihood that the results are representative of the North American orthodontic resident cohort as a whole.

4.11 Future Research

The current study provided a platform for future research into the area of debt amongst orthodontic residents. Due to the cross-sectional nature of the study, correlations, not causations, were identified. Future research in the form of prospective studies could remedy this and potentially identify whether higher levels of debt are causing increased

levels of stress and fear of debt, and whether increased knowledge and contemplation about loans causes lower debt levels. With this information, prospective orthodontic residents could educate themselves about loans and potentially minimize their debt obligations during their careers.

Future research focusing only on orthodontic residents at the time of graduation, repeated over many years, would provide further insight into student debt levels in the profession. Firstly, this would eliminate errors in residents trying to predict their debt upon graduation in the future, and secondly it could identify trends in graduates as time goes on, in particular whether debt levels, stress levels, attitudes towards debt, financial literacy and math anxiety are changing with successive years of graduates entering the profession.

The current study asked orthodontic residents to estimate how long they anticipate it will take to repay their loans. This is a crucial part of the situation as it determines the financial impact of debt. However, asking students how long they think it will take to repay their loans doesn't account for whether these time frames are realistic. Orthodontic residents may be overly ambitious with how quickly they think they can repay their loans, and they may underestimate the effect of taxes and compounding interest on their loan. The current study calculated, that on average, residents anticipate repaying their debts at a rate of \$62,172 per year. As this represents almost half of an orthodontist's average net pay, this is likely an ambitious rate to repay debt. It appears that orthodontic residents are unrealistic about their future salary and ability to repay debt. Future studies could analyze what amount recent graduate orthodontists are actually able to commit to repaying their debt. In addition, this would provide insight into how recent graduate orthodontists are coping with their debt repayments. This would help provide a more accurate view of what debt repayment commitments are actually required amongst orthodontists and help provide future orthodontists a realistic view of what their debt obligations will require in regards to future repayment.

Chapter 5

5 Conclusions

An online survey was distributed to 1178 current orthodontic residents in North America to better understand the relationships between debt, stress, attitudes towards debt and financial literacy. One hundred and one responses were received, representing an 8.6% response rate. The current study found that:

- 1: The mean anticipated debt level upon graduation of orthodontic residency is \$403,520 per resident.
- 2: Anticipated debt level upon graduation of orthodontic residency is strongly positively correlated to debt upon graduation of dental school, weakly negatively correlated with yearly stipend of orthodontic residency, and moderate positively correlated with yearly tuition of orthodontic residency.
- 3: There is a moderate positive correlation between perceived stress and anticipated debt level upon graduation of orthodontic residency.
- 4: There is a weak negative correlation between knowledge and contemplation about loans and anticipated debt level upon graduation of orthodontic residency.
- 5: There is a moderate negative correlation between fear of debt and anticipated debt level upon graduation of orthodontic residency.

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Appendices

Appendix 1 (Table 8): Full List of Correlations Between Variables

	Length of Program	Yearly Tuition	Yearly Stipend	Dental Debt	Ortho Debt	Non-educational Debt	Maths Anxiety	Tolerant Attitudes Towards Debt	Knowledge and Contemplation About Loans	Fear of Debt	Financial Literacy	Stress
Length of Program	1	.306**	.288**	.077	.170	-.198	.361**	-.080	-.179	-.311**	.002	.034
Yearly Tuition		1	-.154	.254*	.511**	.148	.127	-.215*	.073	.444**	.089	.211*
Yearly Stipend			1	-.194	-.291**	-.082	.235	-.005	.102	.045	.502	.067
Dental Debt				1	.870**	-.061	.064	.045	.001	-.414**	.602	.372**
Ortho Debt					1	-.082	.191	-.010	.002	-.549**	.480	.507**
Non-educational Debt						1	.007	.069	.056	.051	.884	.605
Maths Anxiety							1	.199	-.232*	-.217*	.000	.653**
Tolerant Attitudes Towards Debt								1	.102	.265**	.685	.294**
Knowledge and Contemplation About Loans									1	.356**	.000	.025
Fear of Debt										1	.041	.175
Financial Literacy											1	.034
Stress												1

**** correlation is significant at the $p < 0.01$ level**
*** correlation is significant at the $p < 0.05$ level**
 Ortho Debt = Anticipated debt upon graduation of orthodontic residency
 Dental Debt = Debt upon graduation of dental school

Appendix 2: Survey in its Entirety

Letter of Information and Consent:



Letter of Information and Consent

Project Title: Debt and Stress Amongst Orthodontic Residents

Principal Investigator Contact:

1. Invitation to Participate:

You are being invited to participate in this research study about the financial situation of orthodontic residents because you are currently enrolled in an orthodontic program in North America. We anticipate roughly 200 respondents will be a part of this study.

2. Why is this study being done?

Current orthodontic residents are graduating with record levels of debt, with some individuals amassing over a million dollars in debt.

This study aims to understand the factors influencing the current financial standing of orthodontic residents.

This study is being done as part of a Masters thesis for Dr Timothy Renison who is currently undertaking an orthodontic residency at the University of Western Ontario.

3. How long will you be in this study?

This study will take around 15 minutes to complete.

4. What are the study procedures?

If you choose to participate in the study you will be asked to complete an online survey. The survey will ask questions about

your current emotional state, your financial literacy, your financial standing and attitudes about debt. In addition, there will be questions about your education.

5. What are the risks and harms of participating in this study?
There are no known or anticipated risks or discomforts associated with participating in this study.

If you are experiencing stress you can find help through the American Psychological Association

750 First St. NE, Washington, DC 20002-4242

Contact Support

Telephone: [\(800\) 374-2721](tel:(800)374-2721); [\(202\) 336-5500](tel:(202)336-5500) | TDD/TTY: (202) 336-6123

6. What are the benefits of participating in this study?
Information gathered may provide a more accurate financial picture of orthodontic residents.

There is no direct benefit provided for participants of the study.

7. Can participants choose to leave the study?
If you decide to withdraw from the study, you may do so at any time. Due to the anonymous nature of your data, once your survey responses have been submitted, the researchers will be unable to withdraw your data.

8. How will participants' information be kept confidential?

Your survey responses will be collected anonymously through a secure online survey platform called Qualtrics. Qualtrics uses encryption technology and restricted access authorizations to protect all data collected. In addition, Western's Qualtrics server is in Ireland, where privacy standards are maintained under the European Union safe harbour framework. The data will then be exported from Qualtrics and securely stored on Western University's server.

While we do our best to protect your information there is no guarantee that we will be able to do so. The inclusion of your professional role and organization in dissemination of the results may allow someone to link the data and identify you.

In addition, Western's Health Sciences Research Ethics Board (HSREB) may access study data. There is no identifiable data being collected in this study.

9. Are participants compensated to be in this study?

You will not be compensated for your participation in this research.

10. What are the rights of participants?

Your participation in this study is voluntary. You may decide not to be in this study. Even if you consent to participate you have the right to not answer individual questions or to withdraw from the

the study at any time. If you choose not to participate or to leave the study at any time it will have no effect on your academic career. You do not waive any legal right by consenting to this study.

11. Whom do participants contact for questions?

12. Consent

Do you give consent to participate in this survey? By selecting “yes” you are consenting to participate.

Yes

No

Demographics section:

What is your age?

Age in years

What is your gender?

Male

Female

Other

What is your citizenship?

American

Canadian

Other

What is your race?

White

Hispanic/ Latino

Black/ African American

Asian (East, South, South East)

Middle Eastern/ Arab American

Hawaiian/ Pacific Islander

Native American/ American Indian

Other Minority (specify)

What is your marital status?

Single

Married

Divorced

Other

How many children do you have?

0

1

2

3

4

5+

What year of residency are you in?

1

2

3

4+

Recently graduated

What is the length of your residency? (In months)

Program Length (months)

A horizontal slider bar with a purple circle marker positioned at approximately 85% of the total length.

What is the average yearly tuition for your program?

Yearly tuition (\$)

A horizontal slider bar with a purple circle marker positioned at approximately 20% of the total length.

What is the average yearly stipend in your program?

Yearly stipend (\$)



What did you do in the time between finishing dentistry and starting your orthodontic residency? Select all that apply

- Immediately entered residency
- Studied another program at University
- Worked as an associate/ employee dentist
- Owned a dental clinic
- Worked in Academia
- Served in the military
- Other (please specify)

Debt section:

What do you anticipate your total educational related debt to be upon graduation of your orthodontic residency? (eg tuition, living expenses)

If you have already graduated, enter the debt you had at the time of graduation.

Debt upon graduation (\$)

What was your total student loan debt at the end of dental school? (eg tuition, living expenses)

Debt upon graduation (\$)

What is your current non educational related debt level? (eg mortgage, car payments)

Current debt (\$)



Other than loans, have you received any financial support during your orthodontic residency? Select all that apply:

No

Spouse

Financial gift from family/friends

Scholarship / grants

Part time job

Military support

Other (specify)

How is your educational related debt broken down? (as a percentage so that the total must be equal to 100)

I have no debt (Please set as 100%)	<input type="text" value="0"/>
Family loan %	<input type="text" value="0"/>
Private Loan %	<input type="text" value="0"/>
Government Loan %	<input type="text" value="0"/>
Bank loan %	<input type="text" value="0"/>
Other % (please specify) <input type="text"/>	<input type="text" value="0"/>
Total	<input type="text" value="0"/>

Is the educational related debt you are accruing (have accrued) a source of anxiety in your life?

Yes, a large amount

Yes, a medium amount

Yes, a small amount

Not at all

N/A (I have no debt)

What is your plan after immediately after graduation? (Select all that apply)

Work at a corporate practice

Work at a private practice

Work at a general or pediatric practice

Start a practice

Buy an existing practice

Academics

Military

Undecided

What do you expect your annual income to be 10 years after graduation?

Less than \$100,000

\$100,000 - \$200,000

\$200,000 - \$400,000

\$400,000 - \$600,000

\$600,000 - \$800,000

\$800,000+

How many years do you anticipate it will take you to pay off your student loans?

Less than 2 years

2-5 years

5-10 years

10-15 years

15-20 years

20+ years

Tolerant Attitudes Towards Debt section:

Even if I am earning money now, I can take out a loan for a better life

Strongly agree

Agree

Neither agree nor disagree

Disagree

Strongly disagree

Using student loan money to pay for everyday expenses is ok

Strongly agree

Agree

Neither agree nor disagree

Disagree

Strongly disagree

Using a credit card is a good thing because it allows you to enjoy life as an orthodontic resident

Strongly agree

Agree

Neither agree nor disagree

Disagree

Strongly disagree

It is better to have something now and pay for it later

Strongly agree

Agree

Neither agree nor disagree

Disagree

Strongly disagree

Knowledge and Contemplation About Loans section:

Before taking out a student loan, I always think of how to pay it off first

Strongly agree

Agree

Neither agree nor disagree

Disagree

Strongly disagree

Before taking out a loan, I discuss it with my friends or family

Strongly agree

Agree

Neither agree nor disagree

Disagree

Strongly disagree

I know the terms of my student loans (eg interest rate, approximate monthly payments, deadlines)

Strongly agree

Agree

Neither agree nor disagree

Disagree

Strongly disagree

A student loan is the only type of loan I can take out

Strongly agree

Agree

Neither agree nor disagree

Disagree

Strongly disagree

Fear of Debt section:

Student loan debt puts people off from going to an orthodontic residency

Strongly agree

Agree

Neither agree nor disagree

Disagree

Strongly disagree

I am seriously worried about the debts I am building up while in orthodontic residency

Strongly agree

Agree

Neither agree nor disagree

Disagree

Strongly disagree

Once a person is in debt, it can be very difficult to get out

Strongly agree

Agree

Neither agree nor disagree

Disagree

Strongly disagree

Perceived Stress Scale section:

The questions in this scale ask you about your feelings and thoughts during the last month. In each case, you will be asked to indicate by selecting how often you felt or thought a certain way.

	never	almost never	sometimes	fairly often	very often
In the last month, how often have you been upset because of something that happened unexpectedly?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
In the last month, how often have you felt that you were unable to control the important things in your life?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
In the last month, how often have you felt nervous and "stressed"?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
In the last month, how often have you felt confident about your ability to handle your personal problems?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
In the last month, how often have you felt that things were going your way?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

In the last month, how often have you found that you could not cope with all the things that you had to do?

In the last month, how often have you been able to control irritations in your life?

In the last month, how often have you felt that you were on top of things?

In the last month, how often have you been angered because of things that were outside of your control?

In the last month, how often have you felt difficulties were piling up so high that you could not overcome them?

Financial Literacy section:

Suppose you borrowed \$20,000 to help cover your orthodontic tuition payments for the coming year. You can choose to repay this loan over 10 years, 20 years, or 30 years. Which of these repayment options will cost you the least amount of money over the length of the repayment period?

10 year repayment option

20 year repayment option

30 year repayment option

All the same

Don't know

Imagine that the interest rate on your savings account was 2% per year and inflation was 4% per year. After 1 year, would you be able to buy:

More than today with the money in this account

Exactly the same as today with the money in this account

Less than today with the money in this account

Don't know

Refuse to answer

Suppose you have \$1000 in a savings account and the interest rate is 2% per year and you never withdraw money or interest payments. After 5 years, how much would you have in this account in total?

More than \$1100

Exactly \$1100

Less than \$1100

Don't know

Refuse to answer

Suppose you owe \$2000 on your credit card. You pay a minimum payment of \$20 each month. At an annual percentage rate of 12% (or 1% per month), how many years would it take you to eliminate your credit card debt assuming no additional new charges?

Less than 5 years

Between 5 and 10 years

Between 10 and 15 years

Never

Don't know

Refuse to answer

Financial Workshop Question:

Have you ever attended personal finance classes or workshops?

No

Yes, in high school (one time event)

Yes, in high school (long term course or repeated sessions)

Yes, in college/ university (one time event)

Yes, in college/ university (long term course or repeated sessions)

Yes, outside of school (one time event)

Yes, outside of school (long term course or repeated sessions)

Math Anxiety Scale section:

On a scale of 1 (not anxious) to 10 (very anxious), how maths anxious are you?

Anxiety level



Covid Section:

Are you worried about the current COVID-19 pandemic?

Not at all worried

Somewhat worried

Very worried

Extremely worried

Don't know

How concerned are you about each of the following potential impacts of the COVID-19 pandemic for yourself?

	Not at all concerned	Somewhat concerned	Very concerned	Extremely concerned	Don't know
I will have more difficulty paying for tuition and living expenses next term	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I will have to take on more student debt	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The quality of my orthodontic education will be negatively impacted	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
My job prospects after graduation will not be as good	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Appendix 3: Email Script



Dear Orthodontic Resident,

You are being invited to participate in a study titled “Debt and stress amongst orthodontic residents” that I am conducting for my thesis in the Graduate Orthodontics program at the University of Western Ontario, under the supervision of Principal Investigator Dr Ali Tassi and co-investigator Prof Daniel Ansari.

I am hoping to assemble information regarding student debt, stress, and attitudes towards debt. As a current orthodontic resident, I kindly request your participation in our 15 minute online survey. All participant responses will be anonymous and no identifiable information is collected. If you have any questions about this study, or would like a summary of the findings, please do not hesitate to contact me via email or phone (see below).

If you would like to participate, please click on the link below to access the survey:

https://uwo.eu.qualtrics.com/jfe/form/SV_7O0Em1tXxSFW14F

Thank you,

Dr Timothy Renison

Schulich School of Dentistry - Orthodontics

The University of Western Ontario

Appendix 4: Reminder Email Script



Reminder Email Script for Recruitment

Invitation to participate in research

An email was sent to you 2 weeks ago and we wanted to send you a quick reminder about our study.

You are being invited to participate in a study titled “Debt and stress amongst orthodontic residents” that I am conducting for my thesis in the Graduate Orthodontics program at the University of Western Ontario, under the supervision of Principal Investigator Dr Ali Tassi and co-investigator Prof Daniel Ansari.

If you would like to participate, please click on the link below to access the survey:

https://uwo.eu.qualtrics.com/jfe/form/SV_7O0Em1tXxSFW14F

Thank you,

Dr Timothy Renison

Schulich School of Dentistry - Orthodontics

The University of Western Ontario

Appendix 5: Ethics Approval



Date: 24 April 2020

To: Dr. Ali Tassi

Project ID: 115174

Study Title: The relationship between debt and stress amongst orthodontic residents

Application Type: HSREB Initial Application

Review Type: Delegated

Full Board Reporting Date: 05/May/2020

Date Approval Issued: 24/Apr/2020

REB Approval Expiry Date: 24/Apr/2021

Dear Dr. Ali Tassi

The Western University Health Science Research Ethics Board (HSREB) has reviewed and approved the above mentioned study as described in the WREM application form, as of the HSREB Initial Approval Date noted above. This research study is to be conducted by the investigator noted above. All other required institutional approvals must also be obtained prior to the conduct of the study.

Documents Approved:

Document Name	Document Type	Document Date
emailscriptversiondate2242020	Email Script	Received April 24, 2020
Letter of Information and Consent versiondate2242020	Written Consent/Assent	22/Apr/2020
Recruitment Email Reminder 1 versiondate2242020	Email Script	22/Apr/2020
Recruitment Email Reminder 2 versiondate2242020	Email Script	22/Apr/2020
Recruitment Email Reminder 3 versiondate2242020	Email Script	22/Apr/2020
Research Plan versiondate2242020	Protocol	22/Apr/2020
Surveyversiondate2242020	Online Survey	22/Apr/2020

No deviations from, or changes to, the protocol or WREM application should be initiated without prior written approval of an appropriate amendment from Western HSREB, except when necessary to eliminate immediate hazard(s) to study participants or when the change(s) involves only administrative or logistical aspects of the trial.

REB members involved in the research project do not participate in the review, discussion or decision.

The Western University HSREB operates in compliance with, and is constituted in accordance with, the requirements of the TriCouncil Policy Statement: Ethical Conduct for Research Involving Humans (TCPS 2); the International Conference on Harmonisation Good Clinical Practice Consolidated Guideline (ICH GCP); Part C, Division 5 of the Food and Drug Regulations, Part 4 of the Natural Health Products Regulations, Part 3 of the Medical Devices Regulations and the provisions of the Ontario Personal Health Information Protection Act (PHIPA 2004) and its applicable regulations. The HSREB is registered with the U.S. Department of Health & Human Services under the IRB registration number IRB 0000940.

Please do not hesitate to contact us if you have any questions.

Sincerely,

Karen Gopaul, Ethics Officer on behalf of Dr. Philip Jones, HSREB Vice-Chair

Note: This correspondence includes an electronic signature (validation and approval via an online system that is compliant with all regulations).

Curriculum Vitae

Name: Dr Oscar Renison

Post-secondary Education and Degrees: Griffith University
Gold Coast, QLD, Australia
2009-2013 Bachelor of Oral Health in Dental Science,
Graduate Diploma of Dentistry

The University of Western Ontario
London, Ontario, Canada
2018-2021 MCID

Honours and Awards Griffith University Academic Excellence award 2011,
2012, 2013
Class Graduation Ranking: 2nd of 88 students