

The Effect of Orthodontic Appliances on the Evaluation of the Professionalism and Esthetics of an Adult Employee

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THE EFFECT OF ORTHODONTIC APPLIANCES ON THE
EVALUATION OF THE PROFESSIONALISM AND
ESTHETICS OF AN ADULT EMPLOYEE

by

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ABSTRACT
THE EFFECT OF ORTHODONTIC APPLIANCES ON THE
EVALUATION OF THE PROFESSIONALISM AND
ESTHETICS OF AN ADULT EMPLOYEE

Laura H. Vaccariello, DMD

Marquette University, 2016

This study explored the influence of fixed and removable orthodontic appliances on participants' ratings of the job performance, intelligence, and attractiveness of an adult female.

Ninety-four adult subjects were recruited from the Graduate School of Management at Marquette University. Each subject received an identical employee performance review with an attached photograph of a female employee. The smile of the photo was manipulated to represent one of four conditions: no orthodontic appliance, a metal orthodontic appliance, a ceramic orthodontic appliance, or a clear aligner. Subjects then rated the employee on three continuous Likert scales.

Ratings of job performance, intelligence, and attractiveness were not correlated. There were no significant differences between the types of orthodontic appliance for overall ratings of job performance, intelligence, and attractiveness. However, when analyzed by the subject's gender, there was a significant interaction between gender and type of orthodontic appliance pictured for intelligence ratings. Female respondents rated the photos with the metal appliance with lower intelligence than the photo with the clear aligner while male respondents answered in the opposite manner.

Background facial attractiveness may be a better predictor than smile esthetics of the psychosocial ratings of individuals. However, both gender and the presence or absence of an orthodontic appliance can influence assessments of perceived intelligence or similar qualities in the workplace.

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INTRODUCTION

Over the last decade, the prevalence of adults seeking orthodontic treatment has drastically increased. In the United States, it is estimated that approximately 30% of patients seen in orthodontic offices are 18 years or older.²³ In the United Kingdom, a survey of orthodontists revealed that public and private orthodontists start approximately 20 to 28 new adult patients each year.⁵ According to the Wall Street Journal and the American Association of Orthodontists, approximately 1.2 million adults received orthodontic treatment in 2012; this was a 39% increase from 1996.²⁴ These increasing numbers of patients seeking orthodontic treatment raise questions about how orthodontic treatment might affect the lives of these patients.

Though each patient has their own reason for starting treatment, most adults are self-motivated to begin treatment. Most commonly, patients present to the orthodontist with the desire to straighten their teeth and improve their smiles.²⁰ In 1998, Bergstrom et al. surveyed over 200 adult patients to determine their perspectives of visible orthodontic appliances. Of the subjects surveyed, 67% of the adults responded that they would be willing to wear braces as an adult.³ They assert that advances in ceramic brackets, clear aligners, as well as lingual appliances appeal to adults who are self-conscious about wearing traditional appliances.²⁴ These new and esthetic appliances are acceptable to many adults, and patients are even willing to pay more for these alternative treatment modalities.²⁶

In addition to their esthetic concerns, many adult patients acknowledge other external factors that prompt them to begin orthodontic treatment.²⁰ The WHO defines

health as a “state of complete physical, mental, and social well-being.”²² Several studies have demonstrated a correlation between dental malocclusions and a poor oral health quality of life.^{7,12} Patients not only expect an improvement in their appearance with orthodontic treatment, but they anticipate an enhancement in confidence and self-esteem once they have completed the treatment.²⁰ There is some support for patients’ positive expectations for treatment; Varela et al. described an overall improvement of patient body image at just 6 months into orthodontic treatment and facial body image also improved after the conclusion of treatment.²⁹ Overall, patients demonstrate an improvement in self-esteem following treatment.²⁰ Thus, orthodontic therapy can enhance the patient’s psychosocial, subjective sense of well-being.¹¹

LITERATURE REVIEW

In a classic 1972 article, Dion et al. examined the theory that “What is beautiful is good.” They demonstrated that attractive individuals are perceived as more socially desirable and professionally capable than less attractive individuals.⁸ Attractive individuals are ascribed more social competence than unattractive individuals; other studies have demonstrated that this same trend is exhibited for ratings of effectiveness, adjustment, and intellectual competence.⁹ While some researchers have questioned the generalizability of the Dion et al. study, overall, meta-analytic analyses demonstrate that individuals who are rated as being more attractive are evaluated more positively than unattractive individuals, and achieve improved life outcomes when compared to those rated as less attractive.¹³

These findings generalize to the employment setting. In their meta-analysis, Hosada et al. assessed the effect of attractiveness on several job-related outcomes such as hiring, promotions, and performance evaluations. They concluded that the physical attractiveness of a person was consistently advantageous to that individual and there was a direct relationship between attractiveness and several of the career outcomes for both males and females. The advantage associated with attractiveness was conferred despite the amount of other job-relevant information presented to the reviewers such as performance reviews, interviews, etc.¹³ Similarly, Jackson et al. demonstrated an association between attractiveness and competence in the workplace and extended these findings to show that the attractiveness of individual had an even stronger effect on job outcomes if that individual’s performance was low.¹⁵

Agathe et al. not only examined the influence of attractiveness on hiring decisions, but also evaluated the participants' preference for social interaction with individuals in the workplace of differing attractiveness. They found that participants preferred to interact with attractive individuals of the opposite sex, but these same tendencies did not exist for same sex interactions. Thus, the advantage conferred by attractiveness did not always apply when interacting with members of the same sex. Their findings indicated that the willingness of a participant to interact with the individual was associated with the decision to hire the individual, but attractiveness did not significantly influence the hiring decision.¹

Many studies have attempted to examine the relationship between dental appearance and social attractiveness ratings. For example, Newton et al. examined the effects of apparent dental decay on the evaluation of a subject. Two hundred undergraduate students were given a photo of an adult male; half of the subjects received a photo stimulus with dental disease while the other half evaluated a photo that had no apparent disease. Overall, the individuals portrayed with a healthy, disease-free smile were judged to be more socially, intellectually, and psychologically competent than the individuals with visible dental disease.¹⁸ Similarly, Beall et al. altered a set of photographs to mimic the effects of restorative dentistry on an individual's dental appearance. Half of the photos revealed the subject's "before" smile while the other half represented the smile "after" cosmetic dentistry was completed. They found that the individuals pictured with altered smiles were regarded as more attractive, intelligent, and successful in their careers as compared to those with unaltered "before" smiles². Thus, dental appearance can influence the psychosocial evaluation of an individual.

Similar to the evaluation of dental health on attractiveness ratings, several studies have investigated the influence of a malocclusion on the assessment of an individual's attractiveness. Shaw et al. modified the photos of 4 individuals, 2 attractive and 2 unattractive, to evaluate the differences in social attractiveness ratings with different conditions and positions of the incisors. They included photos with normal, crowded, protrusive, or missing incisors as well as the presence of a cleft lip. The photos of individuals with normal incisor relationships were rated significantly higher than those with malocclusions in perceived friendliness, social class, popularity, and intelligence. The females pictured were rated more harshly than their male counterparts. However, the overall facial attractiveness (attractive vs. unattractive) was a stronger predictor of perceived social attractiveness than dental appearance.²⁷

Adding to these findings was a study by Olsen et al. who investigated the influence of several other types of malocclusion on the ratings of attractiveness, intelligence, and 5 personality factors of a pictured individual. They included photos that were manipulated to display excess overjet, negative overjet, a deep bite, an open bite, crowding, and spacing as well as photos with normal occlusion. In keeping with findings from other studies, the photos with a normal occlusion were rated as most attractive, intelligent, agreeable, and extraverted. The photos with negative overjet, mimicking a class III patient, were rated lowest in attractiveness, intelligence, and extroversion. Contrary to Shaw et al.'s study, the females pictured were rated more positively than the males. Additionally, older, less educated subjects rated the photos more favorably than their younger, higher educated counterparts.¹⁹ Taken together, these

studies suggest that the presence of a dental malocclusion can influence how personal attributes are assigned.

Pithon et al. extended the past research on the influence of malocclusion to the workplace hiring practices for a commercial company. They compared the likeliness of being hired, intelligence, honesty, and efficiency at work for candidates with a malocclusion versus those with an ideal smile. Ten photos were manipulated to illustrate several different types of malocclusion; the same individual was also shown with an ideal occlusion. Adult subjects from a Human Resources company responsible for hiring applicants for jobs in sales were the raters. Ultimately, they found that the raters indicated that the individuals depicted in the photos with an esthetic smile were more likely to be hired than their counterparts with a malocclusion. Of interest is the fact that the influence of these photos went beyond influencing hiring decisions; individuals pictured with the normal occlusion were rated as significantly more intelligent than the same photo with the flawed smile.²¹

Facial features other than a malocclusion have also been shown to affect a rater's perception of a photograph of an individual. Madera et al. examined the influence of a facial stigma, such as a scar or port wine stain, on the evaluation of an applicant in an interview. They used eye-tracking technology as well as subjective applicant ratings and recall from the interview to determine the implication of these stigmas on the reviewers. In keeping with earlier findings about malocclusions, they found that there was a significant effect of the stigma on the interviewer's visual attention to the applicant. When a stigma was present, the participants focused more of their attention on the area with the stigma. These facial characteristics were also found to potentially influence

employment decisions; the participants who interviewed a facially stigmatized applicant rated the applicant lower and recalled less information about them after the interview.¹⁷ In summary, an individual's facial features and perceived attractiveness can influence several job-related outcomes.

Several studies have examined the influence of fixed orthodontic appliances on the layperson's ratings of attractiveness. These studies have concluded that clear aligners and simulated lingual appliances are the most attractive treatment modality, followed by ceramic appliances and then metal appliances.^{26,31} Even older children tend to rate clear orthodontic appliances higher than younger children.³⁰ However, despite the increased ratings of attractiveness of ceramic brackets, attractiveness did vary with wire selection and tie variation.³¹ Ceramic brackets with discolored ties were rated lower in overall acceptability when compared to other esthetic appliances.³⁰

How does orthodontic treatment affect how patients are perceived? In 2009, Berto et al. investigated this question examining the smile esthetics of several different versions of the same full-face photograph. Each photograph was manipulated to display a metal appliance, a clear appliance, rubber bands of varying colors, or missing maxillary premolars, simulating a common adult extraction pattern. Fifty orthodontists and fifty laypeople evaluated and rated the esthetics of the photos. The photos with visible extraction spaces had significantly lower attractiveness ratings, but the presence of a metal appliance did not affect the smile assessment. However, laypeople identified the esthetic brackets as less attractive than the metal appliance; this same bias did not exist within the orthodontist raters.⁴

Jeremiah et al. continued to investigate the influence of orthodontic appliance on the evaluation of a person's physical attractiveness, but they also assessed how the appliance would influence social attractiveness ratings. The investigators manipulated the photo of a young, female adult to simulate 5 scenarios: no appliance, fixed metal appliances, fixed ceramic appliances, fixed gold appliances, or clear aligners. They surveyed 125 adults; each subject rated one photo based on attractiveness, social competence, psychological adjustment, and intellectual ability. The authors found that the photos with no appliance or the clear aligner were rated as significantly more attractive than the other groups. Additionally, intellectual ability was rated higher for the photos with no appliance, the clear aligner, or the gold appliance. There were no differences in psychological adjustment or social competence ratings between groups.¹⁶

Individuals with fixed orthodontic appliances also appear to judge their own attractiveness more harshly. Fonseca et al. recruited 60 volunteers to evaluate themselves in a mirror with no appliance, a fixed metal appliance, and a fixed ceramic appliance. The subjects rated themselves most attractive with no appliance and least attractive with a metal appliance in place. The study continued with a peer evaluation of the photos under the same conditions; the photos were rated on beauty, intelligence, ridiculousness, extroversion, and success. They found that there were no significant differences in any rating between the photos with fixed appliance and those with no appliance. Interpersonal social and physical judgments were not influenced by the absence or presence of orthodontic appliances.¹⁰

Past research has established a relationship between dental appearance and an individual's perceived attractiveness and intellectual abilities.^{2,6,7,15,18,19,27} Furthermore,

this relationship can influence job-related outcomes such as of likelihood of hiring and professional ability.^{1,13,17,21} The present study aimed to explore the influence of several orthodontic appliances on the esthetic assessment, the intelligence ratings, and the workplace performance appraisal of a pictured individual. Although several studies have evaluated how orthodontic appliances affect measures of attractiveness and intelligence, the results have been inconsistent. Moreover, no other studies have evaluated the effect of a visual orthodontic appliance on professional assessments of individuals with the appliances. Additionally, due to conflicting research on the influence of gender on similar judgments, this study also aimed to evaluate the gender biases of these ratings.

METHODS

This study evaluated the influence of fixed and removable orthodontic appliances on the assessment of the attractiveness, job performance, and intelligence of a photographed adult female subject. Marquette University's Institutional Review Board in the Office of Research Compliance approved the research proposal. The study was submitted as an "Exempt" activity under Category #2 of 45 CFR 46.101(b) since the research design utilized an anonymous survey with no subject identifiers. The survey protocol complied with Marquette University's Human Research Protection Policy.

Adult students from the Marquette University Graduate School of Management from the Master's Degree program in Accounting, Human Resources, Applied Economics, and Business Administration programs were recruited as subjects. Course listings and faculty email addresses were obtained from the Marquette Graduate School of Management. Several faculty members were contacted directly to inquire if the survey could be distributed to their classes at the start of a class lecture period. The survey was administered in the following graduate business courses: Training and Development (Human Resources), Managerial Economics (Economics), Economics Foundations (Foundations), Organizational Behavior (Management), and Operations and Supply Chain Management (Operations and Supply Chain Management). Participation was strictly voluntary, and the participants were told that they could withdraw from the study at any time. Participants were not informed of the study's association with the Dental school or the orthodontic department to prevent any bias, but they were given enough information about the nature of the study to give consent.

Subjects were given an informed consent form and were told that they would be giving their reaction to a performance review for a female employee at a local company. Each subject was presented with one photograph and a completed employee performance review for the pictured individual. Stimulus photographs were obtained from H.G. Jeremiah et al.'s methods section (Figure 1); the photograph with fixed gold appliances was omitted due to lack of prevalence in current clinical practice in the United States¹⁶. Permission was given from both the Oxford Journals as well as the primary authors for the use of the photographs in the study (Appendix A). The photographs were full-face, color photographs of the same adult female with four separate conditions: no appliance, metal fixed appliances, ceramic fixed appliances, or clear aligners¹⁶.

An identical employee performance review accompanied each photograph. The performance review was developed to reflect an average overall performance (3/5) in the workplace (Figure 2). Following the presentation of the photo and performance review, subjects were asked three questions:

- 1) How would you rate this employee's performance?
- 2) Does this employee appear to be intelligent?
- 3) How attractive is this employee?

The first two questions were obtained from Pithon et al.'s methods in their cross-sectional study on the dental esthetic influence of hiring practices.²¹ The third question was adapted from H.G. Jeremiah's methods.¹⁶ These questions were rated on a continuous visual analog scale (VAS) from 0 to 100 mm (See Appendix B for survey copy). VAS was chosen for its reliability and validity for rating dental and facial attractiveness.¹⁴ Each rating was measured with a standard ruler to the millimeter;

ratings between the markings were rounded up to the nearest millimeter. Subjects' ratings and demographic information were transferred to Microsoft Excel and analyzed using SPSS (Statistical Package for the Social Sciences).

Upon completion of the survey, subjects were asked to complete basic demographic information of gender, age group, highest level of education completed, ethnicity, employment status, and management experience. All of the ninety-four subjects completed this demographic information.

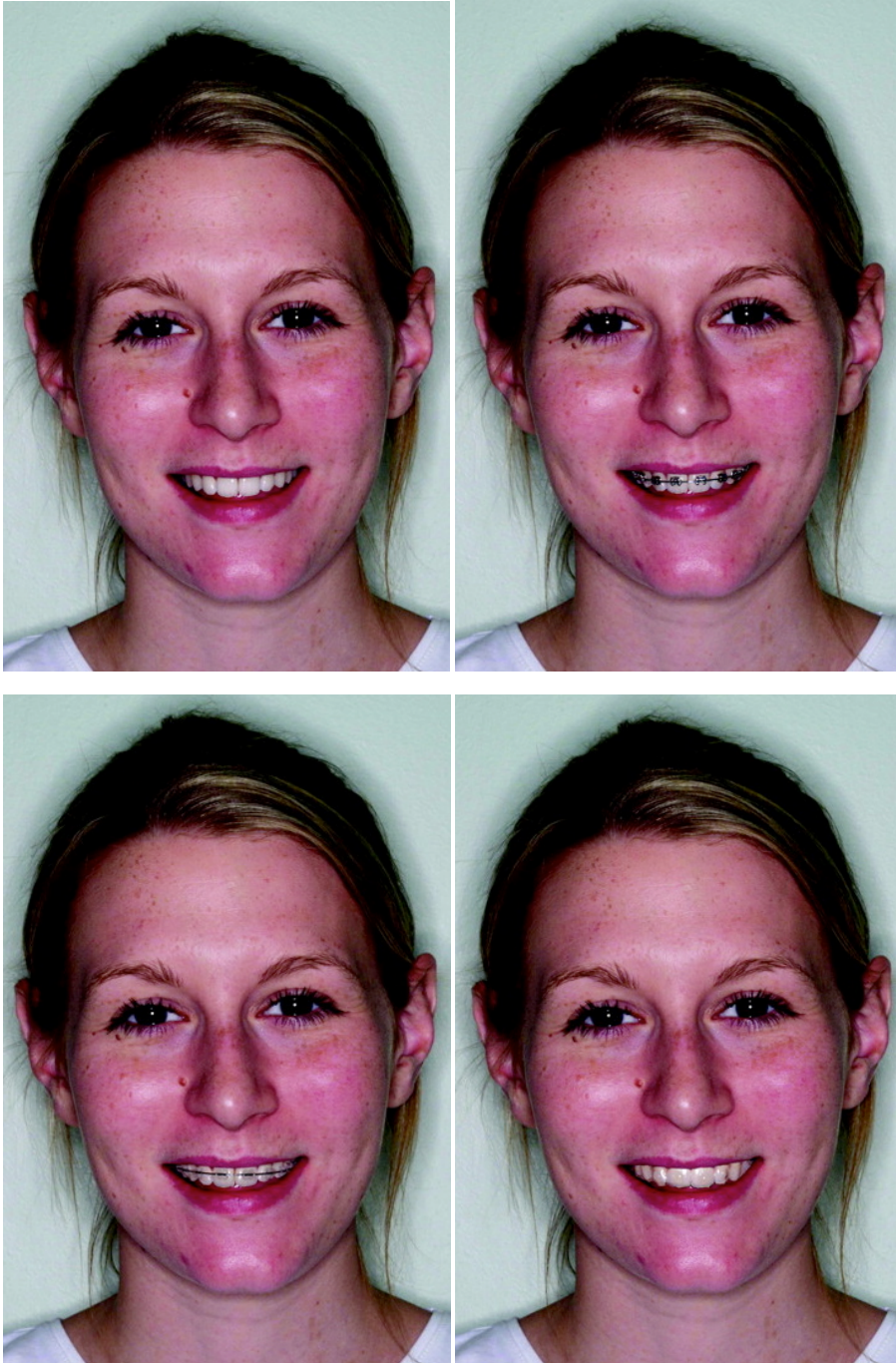



Figure 1: Photos from Jeremiah et al. showing a photograph of young adult female with a) no appliance, b) stainless steel fixed orthodontic appliance, (c) ceramic fixed orthodontic appliance, and (d) clear aligner¹⁶ (Photo ©Oxford University Press)

Employee Performance Review

Employee Information

| | |
|----------------------|------------------------------|
| Employee Name | Jane Doe |
| Job Title | Business Development Manager |
| Department | Business Development |
| Review Period | January-June 2015 |



Ratings

| | 1=Unacceptable | 2=Improvement Needed | 3=Meets Expectations | 4=Exceeds Expectations | 5=Outstanding |
|------------------------------------|--|-------------------------------------|-------------------------------------|-------------------------------------|--------------------------|
| Leadership/ Team Management | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <i>Comments:</i> | Quickly assumes a strong leadership role. | | | | |
| Initiative/ Creativity | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <i>Comments:</i> | Takes initiative to pursue new business leads. | | | | |
| Attitude | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
| <i>Comments:</i> | Brings a positive attitude to all assignments. | | | | |
| Communication | <input type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <i>Comments:</i> | Communicates effectively with her team. | | | | |
| Professionalism | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <i>Comments:</i> | Lacks confidence in front of executive/senior leaders. | | | | |

Evaluation

ADDITIONAL COMMENTS: Overall strong performance; seek opportunities to speak out.

Verification of Review

By signing this form, you confirm that you have discussed this review in detail with your supervisor. Signing this form does not necessarily indicate that you agree with this evaluation.

| | | |
|---------------------|--|---------------|
| Employee Signature: | | Date: 6/15/15 |
| Manager Signature: | | Date: 6/15/15 |

Figure 2: Simulated employee performance review (Photo ©Oxford University Press)

RESULTS

Ninety-four participants, 44 females and 50 males, were enrolled in the study.

The data from 2 participants were excluded from the analysis due to incorrect completion of the questions. Demographic data from the 92 subjects is listed in Table 1 below. The majority of subjects were between ages 21 and 29 (N=71). All participants had at least a Bachelor's degree; 40% had completed some graduate school and 14% already obtained a Graduate degree. Of the 92 subjects, 62% of those surveyed were White and 34% were Asian. Almost half (49%) of the participants indicated that they had previous or current experiences supervising employees. The majority (53%) of subjects were employed full-time while 37% were students, 7% worked part-time, and 3% were unemployed.

| Demographic | | N | Percentage |
|-------------------------------|-----------------|----|------------|
| Gender | Male | 49 | 53.3% |
| | Female | 43 | 46.7% |
| Age | 21-29 | 71 | 77.2% |
| | 30-39 | 17 | 18.5% |
| | 40-49 | 3 | 3.3% |
| | 50-59 | 1 | 1.1% |
| Education | Bachelor's | 42 | 45.7% |
| | Some Graduate | 37 | 40.2% |
| | Graduate | 13 | 14.1% |
| Ethnicity | White | 57 | 62.0% |
| | Asian | 31 | 33.7% |
| | Hispanic/Latino | 2 | 2.2% |
| | Two or More | 2 | 2.2% |
| Employment | Full Time | 49 | 53.3% |
| | Student | 34 | 37.0% |
| | Part Time | 6 | 6.5% |
| | Not Employed | 3 | 3.3% |
| Supervision Experience | No | 47 | 51.1% |
| | Yes | 45 | 48.9% |

Table 1: Demographic Data

Pearson's Product Moment Correlation was used to determine the association between the dependent variables of performance, intelligence, and attractiveness. Although the variables are significantly correlated ($p < .05$), the associations were moderate, (Table 2) suggesting that these three scales are independent.

| Variable | Performance | Intelligence | Attractiveness |
|-----------------------|-------------|--------------|----------------|
| Performance | 1.000 | .498* | .317* |
| Intelligence | .498* | 1.000 | .322* |
| Attractiveness | .317* | .322* | 1.000 |

* $p < 0.05$

Table 2: Pearson Moment Product Correlation Analysis for Performance, Intelligence, and Attractiveness

Means for each type of appliance for each of the dependent variables are presented in Figure 3, Table 3. The metal appliance was rated with the lowest performance ratings (52.27) and attractiveness ratings (50.23). The clear aligner group was rated lowest in intelligence (59.91). However, no significant difference was found for the ratings of performance, intelligence, or attractiveness for the various conditions: no appliance, metal fixed appliances, ceramic fixed appliances, or clear aligners.

| Variable | No Appliance | | | Metal Appliance | | | Clear Appliance | | | Clear Aligner | | | Significance P |
|-----------------------|--------------|-------|-------|-----------------|-------|-------|-----------------|-------|-------|---------------|-------|-------|-------------------|
| | N | Mean | SD | N | Mean | SD | N | Mean | SD | N | Mean | SD | |
| Performance | 25 | 57.32 | 10.56 | 22 | 52.27 | 9.98 | 22 | 55.86 | 10.23 | 23 | 56.91 | 7.83 | 0.222 |
| Intelligence | 25 | 63.32 | 10.55 | 22 | 61.68 | 17.35 | 22 | 61.59 | 11.77 | 23 | 59.91 | 14.43 | 0.841 |
| Attractiveness | 25 | 57.12 | 11.65 | 22 | 50.32 | 14.82 | 22 | 55.36 | 15.75 | 23 | 58.91 | 11.58 | 0.167 |

Scale: 0-100 mm on VAS Scale

Table 3: Mean Performance, Intelligence, and Attractiveness Ratings by Appliance

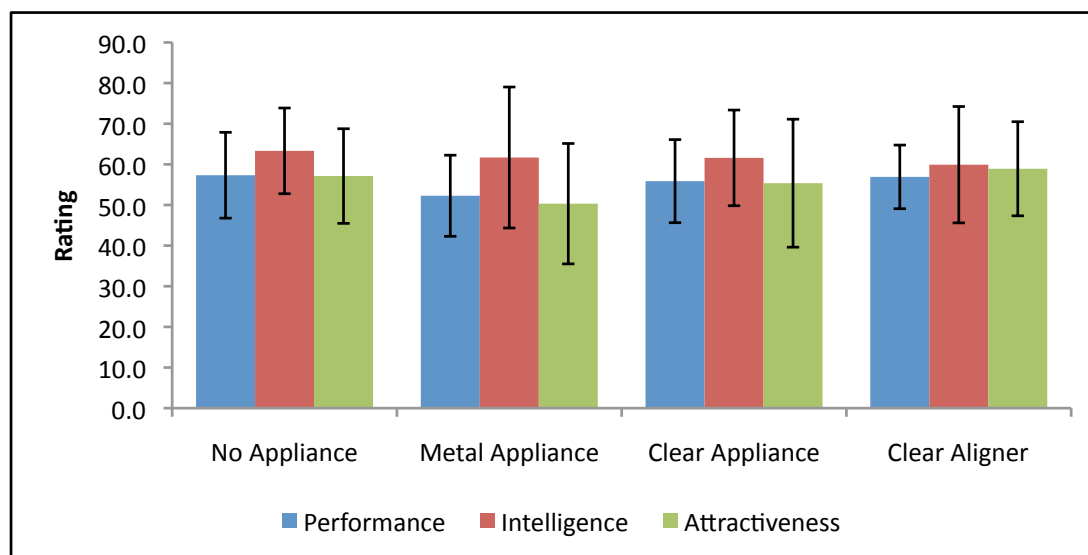


Figure 3: Mean Performance, Intelligence, and Attractiveness Ratings by Appliance

A 4 (Type of Appliance) x 2 (Gender of Respondent) analysis of variance (ANOVA) was used to evaluate the influence of both the participant's gender and the type of appliance on the ratings of performance, intelligence, and attractiveness (Table 4). A main effect was found for the interactions of gender and appliance type for intelligence ratings for the photograph ($F=3.69$, $p=0.015$). There were no significant main effects or interactions for ratings of performance ($F=0.68$, $p=0.57$) or attractiveness ($F=0.23$, $p=0.87$) (Figures 5-7).

In order not to capitalize on chance findings, both the Tukey-Kramer and the LSD post-hoc tests were performed on the data to determine which means triggered the significant interaction for rating of intelligence. The more conservative Tukey-Kramer method failed to show any significant differences among the eight groups. However, the Fischer's Least Significant Difference Test was significant for ratings of intelligence for the metal appliance x gender and the clear aligner x gender (Table 5).

| Measure | Source | df | MS | F |
|--------------------|--------------------|----|--------|------|
| Performance | Appliance Type (A) | 3 | 141.62 | 1.50 |
| | Gender (B) | 1 | 174.41 | 1.84 |
| | AxB | 3 | 64.31 | 0.68 |
| | S(AB) | 84 | 94.74 | |

* $p < 0.05$

| Measure | Source | df | MS | F |
|---------------------|--------------------|----|--------|-------|
| Intelligence | Appliance Type (A) | 3 | 47.64 | 0.28 |
| | Gender (B) | 1 | 173.13 | 1.01 |
| | AxB | 3 | 64.31 | 3.69* |
| | S(AB) | 84 | 171.02 | |

* $p < 0.05$

| Measure | Source | df | MS | F |
|-----------------------|--------------------|----|--------|------|
| Attractiveness | Appliance Type (A) | 3 | 327.72 | 1.73 |
| | Gender (B) | 1 | 2.46 | 0.01 |
| | AxB | 3 | 43.99 | 0.23 |
| | S(AB) | 84 | 189.15 | |

* $p < 0.05$

Table 4: 2x4 ANOVA table Performance, Intelligence, and Attractiveness Ratings by Appliance and Gender

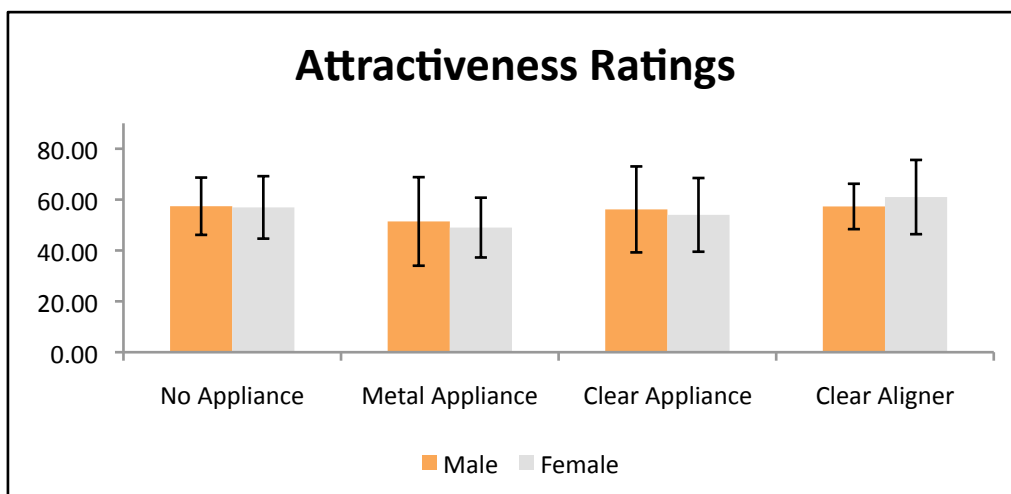
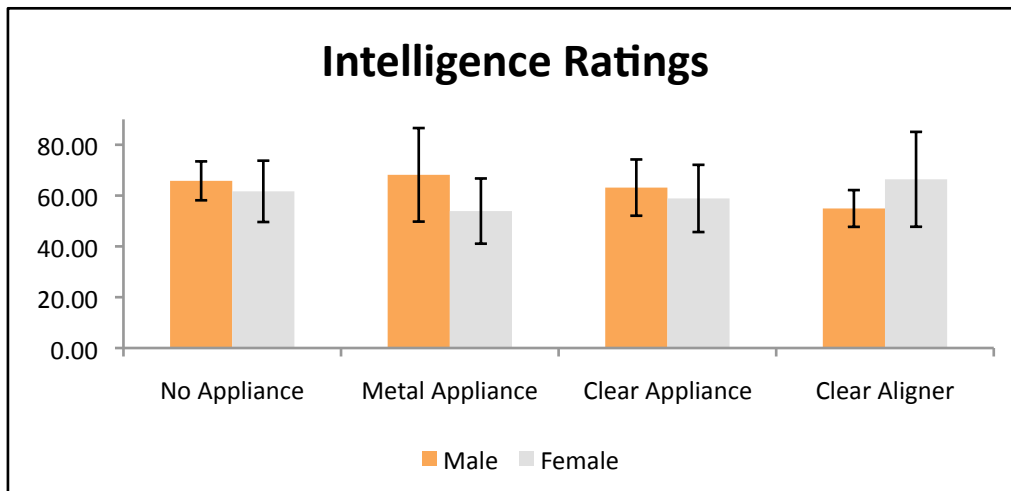
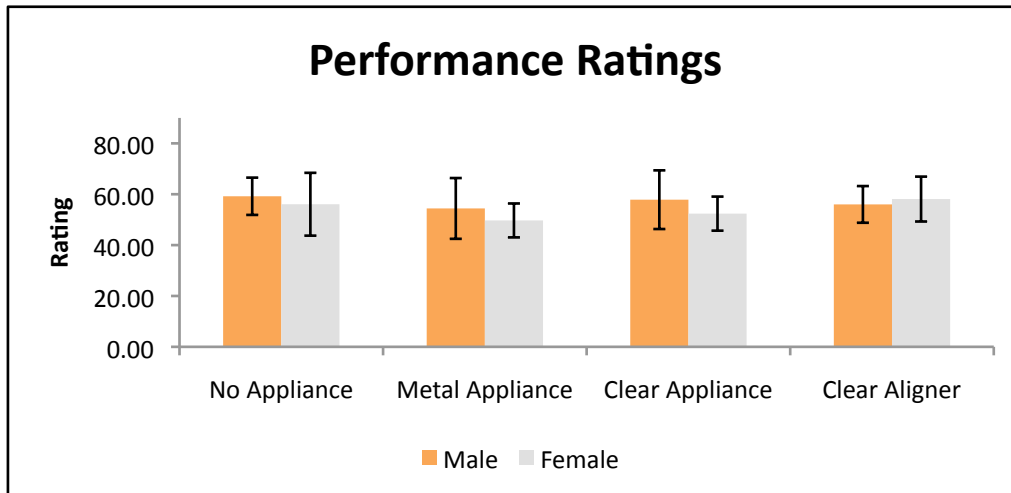


Figure 4: Mean Performance, Intelligence, and Attractiveness Ratings by Appliance and Gender

| Variable | | No Appliance | | | Metal Appliance | | | Clear Appliance | | | Clear Aligner | | |
|----------|----------------|--------------|-------|-------|-----------------|---------|-------|-----------------|-------|-------|---------------|---------|-------|
| | | N | Mean | SD | N | Mean | SD | N | Mean | SD | N | Mean | SD |
| Male | Performance | 10 | 59.20 | 9.75 | 12 | 54.42 | 11.95 | 14 | 57.86 | 11.54 | 13 | 56.00 | 7.21 |
| | Intelligence | 10 | 65.80 | 7.66 | 12 | 68.17** | 18.41 | 14 | 63.14 | 11.07 | 13 | 54.92** | 7.24 |
| | Attractiveness | 10 | 57.40 | 11.27 | 12 | 51.42 | 17.41 | 14 | 56.14 | 16.90 | 13 | 57.31 | 8.92 |
| Female | Performance | 15 | 56.07 | 12.35 | 10 | 49.70 | 6.67 | 8 | 52.38 | 6.70 | 10 | 58.19 | 8.82 |
| | Intelligence | 15 | 61.67 | 12.07 | 10 | 53.90** | 12.84 | 8 | 58.88 | 13.23 | 10 | 58.10** | 8.83 |
| | Attractiveness | 15 | 56.93 | 12.28 | 10 | 49.00 | 11.78 | 8 | 54.00 | 14.49 | 10 | 61.00 | 14.60 |

Scale: 0-100 mm on VAS Scale
 *Tukey Kramer's $p < 0.05$
 **LSD $p < 0.05$

Table 5: Mean Performance, Intelligence, and Attractiveness Ratings by Appliance and Gender

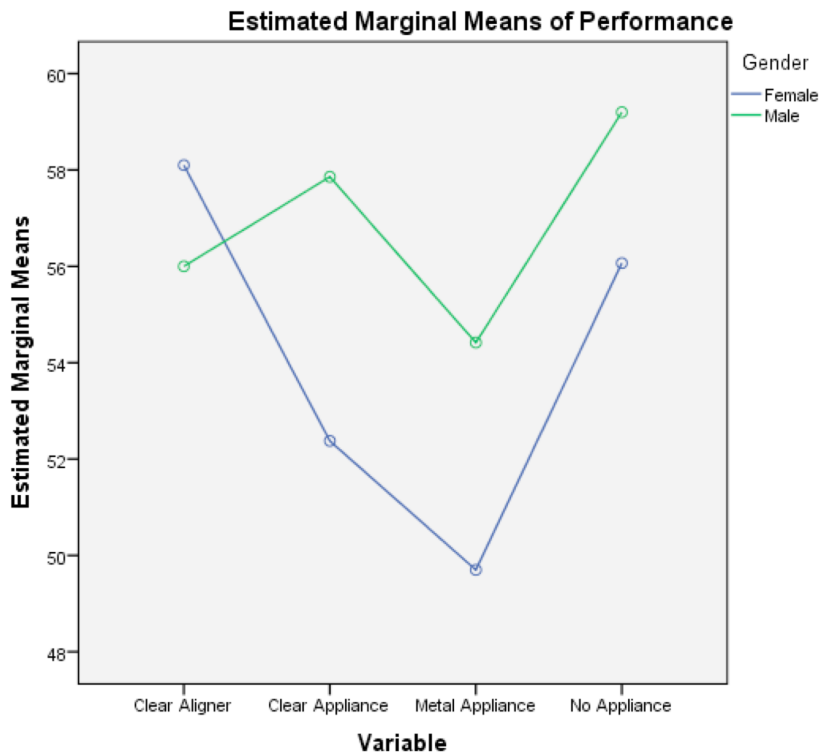


Figure 5: Mean Performance Ratings by Appliance and Gender

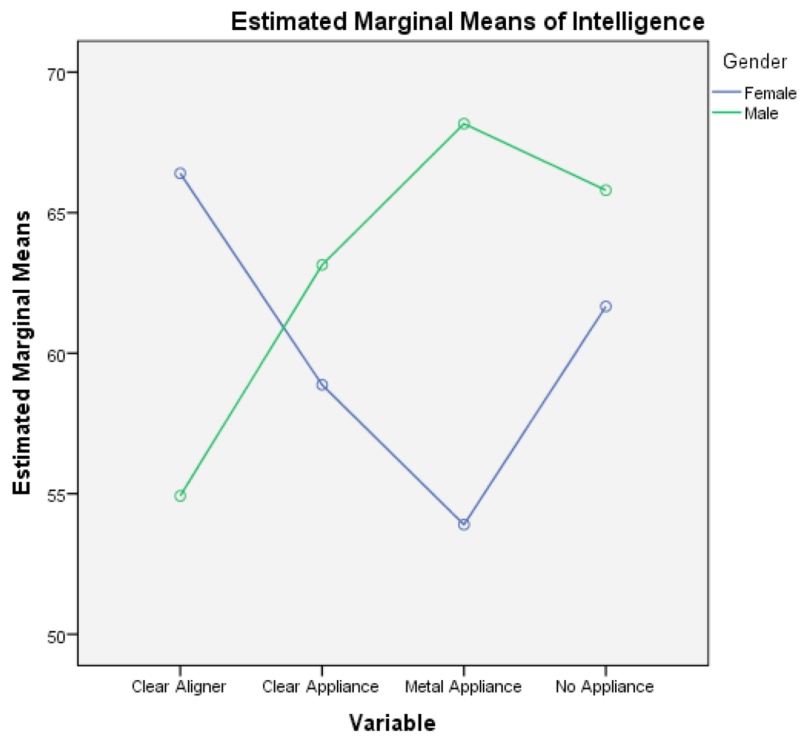


Figure 6: Mean Intelligence Ratings by Appliance and Gender

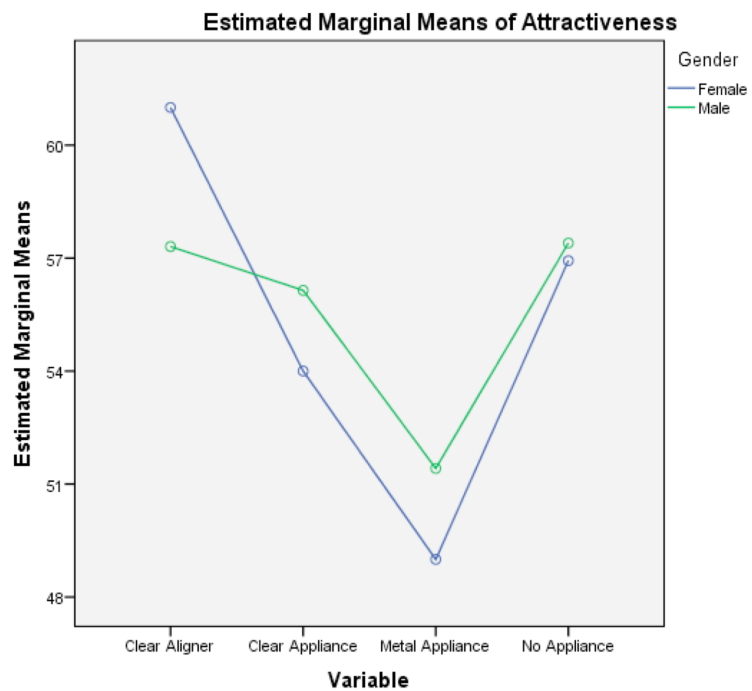


Figure 7: Mean Attractiveness Ratings by Appliance and Gender

DISCUSSION

The present results suggest that the presence of an orthodontic appliance has no influence on the overall attractiveness ratings of an adult employee. Although the fixed metal appliance had the lowest attractiveness ratings, this difference was not statistically significant in this sample. This finding supports the previous findings that orthodontic appliances have no effect on an individual's esthetic evaluation.^{4,10}

Like several other studies, this study utilized a full facial view in each photograph. Consequently, the overall facial attractiveness of the female pictured could have influenced the participants' responses. Chang et al. found that gender and facial attractiveness can have a clinically significant influence on ratings of smile esthetics.⁶ Richards et al. suggested that the stronger the background facial attractiveness, the greater the degree of dental unattractiveness needed in order to influence judgments.²⁵ The smile and teeth of an individual only contribute to overall facial attractiveness; they do not completely define it.²⁸

Past research has suggested that predictive relationships exist between attractiveness and job related outcomes.¹³ On the contrary, our study found that ratings of attractiveness and performance were not significantly related. However, there was no significant difference in performance ratings between or within groups. Even though the performance ratings for the female with fixed metal and ceramic appliance were lower than those with no appliance or the clear aligner, this difference was not significant.

Unlike the presence of a facial stigma such as a birthmark or a port wine stain, the visible presence of a fixed or removable orthodontic appliance did not influence the

participants' ratings of job performance.¹⁷ However, future studies that utilize visual eye tracking software would be needed to determine the extent of visual attention given to the orthodontic appliances.

When the data was analyzed considering the gender of the participants, there was a significant interaction between the gender of the subject and the type of orthodontic appliance pictured for intelligence ratings. Female participants that viewed a photo with a metal fixed appliance rated the pictured female as having lower intelligence than those who viewed the same picture with a clear aligner; conversely, male participants rated the stimulus with the clear aligner significantly lower than the stimulus with the metal appliance.

Like Jeremiah et al.'s findings, we found that the presence of an orthodontic appliance can influence the intelligence ratings of an individual; however, this influence only became apparent when the results were segmented by the gender of the subject.¹⁶ Unlike previous research, our results did not indicate a clear relationship between visible orthodontic appliances and lower intelligence ratings. Instead, our results reveal that gender differences might exist when evaluating the psychosocial characteristics of others with different types of orthodontic appliances.

Agthe et al.'s findings suggested that positive biases do not always apply to same-sex ratings. In their study, individuals preferred to interact with attractive members of the opposite sex, but not always with attractive members of the same sex.¹ These same gender biases could have influenced the interaction between gender and appliance type for intelligence ratings. Our data suggests that the gender of the subject as well as the

stimulus may influence how attributes are evaluated. Future studies using a male stimulus photo could be valuable in continuing to explore this gender biasing.

Our sample consisted of predominantly young, educated adults; however, past studies have demonstrated that younger, higher educated adults tend to be more critical in their ratings of others.¹⁹ Therefore, we can infer that the results obtained from a sample of older adults would most likely not have significant findings. Nonetheless, future studies could evaluate the influence of age, education, or management experience using the same psychosocial ratings. Finally, our methods attempted to stimulate the evaluation of an employee by co-worker or manager in the workplace. Like other analog studies, it is difficult to determine the applicability of the results to real world workplace. It is challenging to establish the true effect of the appearance of visible orthodontic appliances on how an employee is evaluated although there are findings that suggest that orthodontic appliances influence these ratings.

CONCLUSION

As the number of adult orthodontic patients grows in the United States and in the world, orthodontists must be able to address this population's complex treatment needs. Since the appearance of the selected orthodontic appliance is one of these patients' greatest concerns, clinicians must help the patient make an informed decision about the appliance they select.⁵

Within the limitations of our study, the results of our study found no support for the assertion that the selection and visibility of the orthodontic appliance used has an effect on the esthetic assessment or workplace performance evaluation of an individual. Though near invisible appliances such as clear aligners or lingual braces are perceived as more attractive than their ceramic and metal appliance counterparts, this evaluation does not necessarily extend to the esthetic evaluation of the patient.^{26,31} Patients will tend to judge themselves more critically than others will perceive them.¹⁰

However, the type of orthodontic appliance present can influence the appraisal of an individual's perceived intelligence, at least as subjects in the present study interpreted it. Gender biases may exist for different types of orthodontic appliances, both traditional appliances and newer esthetic appliances. Consequently, orthodontists must understand and explain the preconceptions associated with each type of appliance.

Orthodontists must also educate their adult patients about social and psychological benefits of orthodontic treatment. The results of orthodontic treatment can improve esthetics, but also self-esteem, body image, and psychosocial aspects of the

individual's life.^{11,20,29} The temporary appearance and use of any type of orthodontic appliance serves only as a necessary means to an end treatment goal.

REFERENCES

1. Agthe M, Spörrle M, Frey D, Maner JK. Looking up versus looking down: Attractiveness-based organizational biases are moderated by social comparison direction. *J Appl Soc Psychol*. 2014;44(1):40-45.
2. Beall AE. Can a new smile make you look more intelligent and successful? *Dent Clin North Am*. 2007;51(2):289-97, vii.
3. Bergstrom K, Halling A, Wilde B. Orthodontic care from the patients' perspective: Perceptions of 27-year-olds. *Eur J Orthod*. 1998;20(3):319-329.
4. Berto PM, Lima CS, Lenza MA, Faber J. Esthetic effect of orthodontic appliances on a smiling face with and without a missing maxillary first premolar. *Am J Orthod Dentofacial Orthop*. 2009;135(4 Suppl):S55-60.
5. Cedro MK, Moles DR, Hodges SJ. Adult orthodontics--who's doing what? *J Orthod*. 2010;37(2):107-117.
6. Chang CA, Fields HW, Jr, Beck FM, et al. Smile esthetics from patients' perspectives for faces of varying attractiveness. *Am J Orthod Dentofacial Orthop*. 2011;140(4):e171-80.
7. Choi SH, Kim BI, Cha JY, Hwang CJ. Impact of malocclusion and common oral diseases on oral health-related quality of life in young adults. *Am J Orthod Dentofacial Orthop*. 2015;147(5):587-595.
8. Dion K, Berscheid E, Walster E. What is beautiful is good. *J Pers Soc Psychol*. 1972;24(3):285-290.
9. Eagly AH, Ashmore RD, Makhijani MG, Longo LC. What is beautiful is good, but...: A meta-analytic review of research on the physical attractiveness stereotype. *Psychol Bull*. 1991;110(1):109-128.
10. Fonseca LM, Araujo TM, Santos AR, Faber J. Impact of metal and ceramic fixed orthodontic appliances on judgments of beauty and other face-related attributes. *Am J Orthod Dentofacial Orthop*. 2014;145(2):203-206.
11. Gazit-Rappaport T, Haisraeli-Shalish M, Gazit E. Psychosocial reward of orthodontic treatment in adult patients. *Eur J Orthod*. 2010;32(4):441-446.
12. Hassan AH, Amin H. Association of orthodontic treatment needs and oral health-related quality of life in young adults. *Am J Orthod Dentofacial Orthop*. 2010;137(1):42-47.

13. Hosoda M, Stone-Romero E, Coats G. The effects of physical attractiveness on job-related outcomes: A meta-analysis of experimental studies. *Person Psychol.* 2003;56(2):431-462.
14. Howells DJ, Shaw WC. The validity and reliability of ratings of dental and facial attractiveness for epidemiologic use. *Am J Orthod.* 1985;88(5):402-408.
15. Jackson LA, Hunter JE, Hodge CN. Physical attractiveness and intellectual competence: A meta-analytic review. *Soc Psychol Q.* 1995;58(2):108-122.
16. Jeremiah HG, Bister D, Newton JT. Social perceptions of adults wearing orthodontic appliances: A cross-sectional study. *Eur J Orthod.* 2011;33(5):476-482.
17. Madera JM, Hebl MR. Discrimination against facially stigmatized applicants in interviews: An eye-tracking and face-to-face investigation. *J Appl Psychol.* 2012;97(2):317-330.
18. Newton JT, Prabhu N, Robinson PG. The impact of dental appearance on the appraisal of personal characteristics. *Int J Prosthodont.* 2003;16(4):429-434.
19. Olsen JA, Inglehart MR. Malocclusions and perceptions of attractiveness, intelligence, and personality, and behavioral intentions. *Am J Orthod Dentofacial Orthop.* 2011;140(5):669-679.
20. Pabari S, Moles DR, Cunningham SJ. Assessment of motivation and psychological characteristics of adult orthodontic patients. *Am J Orthod Dentofacial Orthop.* 2011;140(6):e263-72.
21. Pithon MM, Nascimento CC, Barbosa GC, Coqueiro Rda S. Do dental esthetics have any influence on finding a job? *Am J Orthod Dentofacial Orthop.* 2014;146(4):423-429.
22. Preamble to the Constitution of the World Health Organization as adopted by the International Health Conference, New York, 19-22 June, 1946; signed on 22 July 1946 by the representatives of 61 states (official records of the world health organization, no. 2, p. 100) and entered into force on 7 April 1948. .
23. Proffit W, Fields H, Sarver D. *Contemporary orthodontics.* 5th ed. Canada: Elsevier; 2013.
24. Reddy S. Why more adults are getting braces. *Wall Street Journal.* 2015. Available from: http://www.wsj.com/article_email/why-more-adults-are-getting-braces-1444066342-1MyQjAxMTI1NzEyMTgxMjEwWj.

25. Richards MR, Fields HW, Jr, Beck FM, et al. Contribution of malocclusion and female facial attractiveness to smile esthetics evaluated by eye tracking. *Am J Orthod Dentofacial Orthop*. 2015;147(4):472-482.
26. Rosvall MD, Fields HW, Ziuchkovski J, Rosenstiel SF, Johnston WM. Attractiveness, acceptability, and value of orthodontic appliances. *American Journal of Orthodontics and Dentofacial Orthopedics*. 2009;135(3):276.e1-276.e12.
27. Shaw WC, Rees G, Dawe M, Charles CR. The influence of dentofacial appearance on the social attractiveness of young adults. *Am J Orthod*. 1985;87(1):21-26.
28. Tatarunaite E, Playle R, Hood K, Shaw W, Richmond S. Facial attractiveness: A longitudinal study. *Am J Orthod Dentofacial Orthop*. 2005;127(6):676-82; quiz 755.
29. Varela M, Garcia-Camba JE. Impact of orthodontics on the psychologic profile of adult patients: A prospective study. *Am J Orthod Dentofacial Orthop*. 1995;108(2):142-148.
30. Walton DK, Fields HW, Johnston WM, Rosenstiel SF, Firestone AR, Christensen JC. Orthodontic appliance preferences of children and adolescents. *American Journal of Orthodontics and Dentofacial Orthopedics*. 2010;138(6):698.e1-698.e12.
31. Ziuchkovski JP, Fields HW, Johnston WM, Lindsey DT. Assessment of perceived orthodontic appliance attractiveness. *Am J Orthod Dentofacial Orthop*. 2008;133(4 Suppl):S68-78.

APPENDIX A

GRATPERM

Dear Laura,

Re: H. G. Jeremiah, D. Bister, J. T. Newton Social perceptions of adults wearing orthodontic appliances: a cross-sectional study *Euro J Orthodontics* (2011) 33 (5) 476-482, Figure 2

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Guffi

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GRATPERM

Dear Laura,

RE. Fig. 2. H. G. Jeremiah et al. Social perceptions of adults wearing orthodontic appliances: A cross-sectional study. The European Journal of Orthodontics (2011) 33 (5): 476-482

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Please do not hesitate to contact me if I can be of any further assistance.

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6/3/15

Dear Laura Vaccariello,

Thank you for your email. I am happy for the images to be used subject to the appropriate acknowledgements.

So far I have not been able to locate the original consent, but I am confident the female in the photographs will be happy.

I am sorry if this has caused you any delay and good luck with your research.

Yours sincerely,

Huw Jeremiah

6/3/15

Dear Laura,

Fine by me for as long as we are acknowledged. Do you need a copy of the image?

BW

Dirk

6/3/15

Thank you for your interest in our research. I have sent a copy of your email to Dr. Jeremiah who obtained the images and can let you know about the original consent that was given for their use.

Best wishes

Tim

APPENDIX B

MARQUETTE UNIVERSITY RESEARCH INFORMATION SHEET

Evaluation of Employee Performance Review Process

Laura Vaccariello

Marquette University

You have been asked to participate in a research study. You must be age 18 or older to participate. We would like to get your reaction to a performance review. The study involves completing a short survey and will take about 2-3 minutes to complete. There are no foreseeable risks associated with this project, nor are there any direct benefits to you. Your participation is voluntary and you may withdraw from the study at any time.

If you have any questions about this project you can contact Laura Vaccariello at Laura.Vaccariello@marquette.edu.

Thank you for your participation.

Employee Performance Review Evaluation:

Please complete the following questions based on the attached performance review for a female employee, Jane Doe, at a local company. **Please mark your responses with an "X" on the line as shown in the example.**

EXAMPLE:

Unacceptable |-----X-----| Outstanding
0 10

1) How would you rate this employee's performance?

Unacceptable |-----| Outstanding
0 10

2) Does this employee appear to be intelligent?

Strongly Disagree |-----| Strongly Agree
0 10

3) How attractive is this employee?

Very Unattractive |-----| Very Attractive
0 10

Please complete the following demographic information about yourself to help us with our study. Please check your responses.

- 1) What is your gender?
 - Male
 - Female

- 2) What is your age?

| | |
|-----------------------------------|--------------------------------|
| <input type="checkbox"/> Under 17 | <input type="checkbox"/> 50-59 |
| <input type="checkbox"/> 18-20 | <input type="checkbox"/> 60-69 |
| <input type="checkbox"/> 21-29 | <input type="checkbox"/> 70-79 |
| <input type="checkbox"/> 30-39 | <input type="checkbox"/> 80-89 |
| <input type="checkbox"/> 40-49 | <input type="checkbox"/> 90+ |

- 3) What is the highest level of education that you have completed?
 - Less than High School
 - Some High School
 - High School Graduate or equivalent (i.e., G.E.D.)
 - Completed some college, but did not get a degree
 - Technical School or Apprenticeship
 - Associate Degree
 - Bachelor Degree (i.e., B.A., B.S.)
 - Completed some graduate school, but did not get a degree
 - Completed graduate or professional school (i.e., M.S., M.A., Ph.D., MD)

- 4) Ethnicity origin (or Race): Please specify your ethnicity.
 - Hispanic or Latino
 - White
 - Black or African American
 - Native Hawaiian or Other Pacific Islander
 - Asian
 - American Indian or Alaska Native
 - Two or More Race

- 5) Which of the following best describes your employment status?
 - Employed full-time
 - Employed part time
 - Self employed
 - Not employed
 - Retired
 - Student
 - Homemaker

- 6) Have you ever supervised employees?
 - Yes
 - No