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Space closing versus space opening for bilateral missing upper laterals – Aesthetic judgments of laypeople: A web-based survey

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Abstract

Objective: To investigate the opinions of laypeople regarding the aesthetic outcome of treating patients with developmental absence of both maxillary lateral incisors with either orthodontic space closure (OSC) or space opening and prosthetic replacement (PR).

Design: Cross sectional, web-based survey.

Methods: A panel of five orthodontists and five restorative dentists examined the post-treatment intra-oral images of 21 patients with developmental absence of both upper lateral incisors. A consensus view was obtained about the 10 most attractive images (5 OSC; 5 PR). The 10 selected images were used in a web-based survey involving staff and students at the University of Sheffield. In the first section the participants were asked to evaluate the attractiveness of the 10 randomly arranged single images using a 5-point Likert scale. In the second section an image of OSC was paired with an image of PR according to their attractiveness ranking by the clinician panel, and the participants were asked to indicate which of the two images they preferred.

Results: The survey received 959 completed responses with 9590 judgements. The images of OSC were perceived to be more attractive (mean rating 3.34 out of 5; sd 0.56) compared with the images of PR (mean rating 3.14 out of 5; sd 0.58) (mean diff 0.21; $P < 0.001$). Female and staff judges tended to give higher attractiveness ratings. Both females and males preferred the OSC images closing in 3 out of 4 paired images.

Conclusion: Space closing was perceived to be more attractive than space opening by lay people. The findings have implications for advising patients about the best aesthetic outcome when both maxillary lateral incisors are missing.

Key words: Orthodontics; hypodontia; aesthetics

Introduction

Developmentally absent maxillary lateral incisors are a common clinical condition and can lead to a significant social handicap to young people, due to the adverse effect on their dental appearance (Meaney et al., 2012). The two orthodontic treatment options are either to close space, by positioning the maxillary canine next to the central incisor and camouflaging the canine to look more like a lateral incisor (OSC), or to open space for a prosthetic replacement (PR). The debate continues about which approach leads to the most favourable outcome in terms of aesthetics, function and maintenance burden to the patient in the long term (Kokich et al., 2011, Zachrisson et al., 2011, Andrade et al., 2013). The increasing use of skeletal anchorage might enable either OSC or PR to be a viable choice for patients in the future (Ludwig et al., 2013). Researching the aesthetic outcomes for each option is therefore important.

The limited literature in this area suggests that a higher proportion of patients who have had OSC are satisfied with the appearance of their teeth (93%) compared with those who have had PR (65%) (Robertsson and Mohlin, 2000). De-Marchi and colleagues (De-Marchi et al., 2014) found that patients who had undergone OSC, judged their own teeth to be significantly more attractive than a control group, who had not had orthodontic treatment.

There are inconsistencies in the literature regarding the attractiveness assessments of OSC and PR. Armbruster and colleagues (Armbruster et al., 2005a, Armbruster et al., 2005b) found that although a large proportion of general dentists would suggest that a restorative approach produces the best aesthetic solution, many did not rank images of PR as the most attractive outcome. Other studies have found no differences in the attractiveness between OSC and PR (De-Marchi et al., 2014, Barber et al., 2015), but the numbers of people taking part has been generally small.

Web-based surveys have been advocated for a number of years, as a way of obtaining an increased sample size (Eysenbach and Wyatt, 2002, Ahern, 2005, Evans and Mathur, 2005). They have been found an acceptable alternative to paper-based surveys in psychological research (Buchanan and Smith, 1999). Several researchers have used web-based surveys to obtain data about smile aesthetics (Ker et al., 2008, Lin et al., 2013).

The aim of this study was to use a web-based survey to obtain the views of non-dentists concerning the appearance of the upper anterior teeth following OSC or PR. The objectives of the study were to examine two main research questions regarding the judgements of non-dentists:

- Is there a difference in the attractiveness ratings between OCS and PR?

- Is there difference in the proportions who stated a preference for the appearance of OSC and PR?

Participants and methods

The study was undertaken at the Charles Clifford Dental Hospital and University of Sheffield, UK. Ethical approval was obtained from the School of Clinical Dentistry Research Ethics Committee (27 March 2013).

Selection of images for the web-based survey

All orthodontic consultants working in the region of the dental teaching hospital were contacted, using a secure nhs.net e-mail account. They were asked to send the post-treatment intra-oral images of any patients with bilateral, developmentally absent upper lateral incisors, who had been treated by either OSC or PR. Images of 41 patients were collected; however 20 patients did not fulfil the inclusion criteria or were poor quality images and were excluded, leaving the post-treatment images from 21 patients (11 OSC, 10 PR). These were prepared to a standardised format by cropping to show only the upper front teeth. The images were printed, laminated and shown to 10 specialist dentists (5 orthodontists and 5 restorative dentists), who were asked independently to rank the photographs in order of attractiveness, from most attractive (1) to least attractive (22). One repeat space closing image was included to assess intra-observer reliability.

The sum of the rankings for each image was calculated and the five images in the OSC and five images in the PR groups that were most frequently ranked the highest in terms of attractiveness (had the lowest total scores) were used in the main survey (Figure 1). The scores of two expert assessors were excluded due to discrepancies in their repeat scores.

Survey

An online, web-based survey was created using the selected images (www.freeonlinesurveys.com). Following some initial questions to determine the gender and age of the participants, their position at the university (student/staff/other), whether they had anything to do with dentistry or reported a history of orthodontic treatment, the survey was constructed in two parts:

Part 1 (Attractiveness) - consisting of the 10 selected single images (5 OSC and 5 PR), that were ranked highest for attractiveness by the clinicians, placed in a random order. Respondents were asked to assess each image on a 5-point Likert scale ('Very unattractive'; 'Unattractive'; 'Neither attractive or unattractive'; 'Attractive'; 'Very attractive').

Part 2 (Preference) – consisting of four paired images per screen page (one OSC and one PR) that were ranked most attractive by the clinicians. The highest ranked OSC image was placed with the highest ranked PR image, followed by the next ranked images, etc. The OSC and PR images were randomly placed on the left or right side. The respondents to the survey were asked to indicate which image they preferred (left or right). The pair of images deemed most attractive by the clinicians and the pair of images deemed least attractive by the clinicians were included as repeats to test for intra-examiner reliability.

The volunteers list of the University of Sheffield was used to contact potential respondents via e-mail. The Student-volunteers list includes almost all students at the university (approx. 25,000 people) and the volunteers list reaches almost all 6,000 staff. After a short introduction to the study the message invited the recipient to follow a link to the online survey. Respondents were asked to confirm that they were aged 18 years old or older. Those who completed the survey were considered to have provided their informed consent for their anonymised data to be used in the analysis.

Statistics

An *a priori* calculation was undertaken, which determined that a sample size of 140 participants would be sufficient to detect a statistically significant difference of 1 point on the attractiveness scale (SD 1: effect size 0.5) using a two sided paired *t* test with a power of 0.85 and significance level 0.05.

Attractiveness: The 5-point judgements of the 10 photographs were scored from 0 for 'Very unattractive' to 4 for 'Very attractive'. The respondent scores for each of the 5 space opening images were added together and divided by 5 to obtain a mean attractiveness rating for the OSC images. A similar calculation was carried out for the PR images. The distribution of the differences in the attractiveness ratings for the OSC and PR images was found to be normal, and therefore, a paired *t* test was used to test the null hypothesis of no difference in the attractiveness rating between the OSC and PR groups.

Logistic regression was used to test the influence that treatment choice (OSC or PR), as well as assessor-related factors (gender, age, position at the university and whether the respondent reported a history of orthodontic treatment) had on the attractiveness ratings. The participant number was included in the model to take into account that some judges were more generous in their assessments than others. The assessor attractiveness score was the dependent variable. The neutral responses ('Neither Attractive or Unattractive') were excluded from the analysis and the two attractive ratings ('Attractive' and 'Very attractive') were collapsed into one category, as were the two unattractive ratings ('Unattractive' and 'Very unattractive'). The gender of the assessor, age (in

years), position at the university (Staff or Student) and whether they gave a history of orthodontic treatment were entered as independent variables.

For the preference section of the survey a descriptive analysis was undertaken. The inclusion of two repeat paired images was used to test for reproducibility and intra-examiner reliability and the analysis was repeated after the exclusion of those participants who had changed their judgements for either or both repeat images.

All statistics were carried out in PASW Statistics for Windows v20 (SPSS Inc., 444 Michigan Avenue, Chicago, IL, USA).

Results

Figure 2 is a flowchart showing the response to the survey. The total number of responses was 1141 (response rate approximately 4% of those sent the original message) of which 104 had completed only the demographic section, 1037 had completed at least the first two sections, but 78 were excluded because they responded 'Yes' to the question about whether their job was in dentistry. The final number with complete Attractiveness data was 959 and complete Preference data was 942. The details of the respondents are presented in Table 1.

Attractiveness ratings

The 959 completed responses produced 9590 judgements of attractiveness from the ten images (4795 for the five images of OSC and 4795 for the five images of PR). The frequencies of attractiveness responses are shown in Table 2. The proportion of responses that found the images attractive or very attractive was 45.7% for OSC and 40.5% for PR. In contrast 20.1% of responses considered the OSC to be unattractive or very unattractive compared with 29.3% for PR.

The mean attractiveness scores for the OSC and PR are shown in Table 3. The mean scores for the five OSC images were higher than for the five PR images, which suggests that orthodontic space closure with canine camouflage was rated more attractive, on average, than space opening and prosthetic replacement. The difference between the mean scores for individual raters was small (mean difference 0.21; 95% CI 0.18-0.24, on a scale of 0 to 4), but was statistically significant (paired *t* test; $P < 0.001$).

Out of the 9590 judgements, 3095 were neutral ('Neither attractive or unattractive') and were excluded from the logistic regression. The remaining 6495 judgements were included in the analysis and the results are shown in Table 4. Participant was a significant factor in predicting whether an image would be considered attractive, as was whether the image was of OSC or PR ($P < 0.001$). The odds of a PR image judgement being rated 'Attractive' or 'Very attractive' was significantly less than

that of an OSC image (odds ratio 0.61; 95% CI 0.55 to 0.68). Examination of the proportions showed that 69.4% of the OSC judgements were 'Attractive' or 'Very attractive' compared with 58% of the PR judgements. The gender of the judge was also significant ($P < 0.001$) with females giving significantly more attractive judgements than males (65.4% v 57.3%; odds ratio 1.39; 95%CI 1.23 to 1.57), as was the position at the university ($P = 0.02$) with staff being more generous with their attractiveness judgements than students (68.0% v 62.0%; odds ratio 1.30; 95%CI 1.10 to 1.52). The age of the judge ($P = 0.949$) and whether they gave a history of orthodontic treatment ($P = 0.072$) were non-significant.

Preference ratings

The 942 complete responses to the preference section created a total of 3768 judgements about the paired images (942 respondents judging four paired images). On 2244 occasions (59.6%) the respondent expressed a preference for the image of OSC. Examination of the data for the two repeat pairs of images revealed that one third of respondents (313; 33.2%) changed their preference choices between the first and second assessments for one of the repeated images and about one in 14 respondents (68; 7.2%) changed their assessments on both repeat images. These participants' responses were excluded and the descriptive analysis repeated for the remaining 561 participants; however this made little difference to the findings that the majority of responses expressed a preference for the OSC image (1362 out of 2244; 60.7%). A slightly higher proportion of females expressed a preference for the OSC image (61.4%) than males (58.1%).

Discussion

This internet survey of non-dental staff and students at the University of Sheffield has found both slightly higher attractiveness ratings and a majority preference for images of orthodontic space closure and camouflage of the canine, rather than space opening and prosthetic replacement, when the upper lateral incisors are both missing. These findings broadly agree with those of Armbruster and colleagues (Armbruster et al., 2005a, Armbruster et al., 2005b), who sampled the views of dentists, orthodontists, other dental specialists and lay people. The findings are contrary to those of Barber and colleagues (Barber et al., 2015) who found no clinically significant difference in their sample of views from patients and De-Marchi and colleagues (De-Marchi et al., 2014) who found no differences in their sample of dentists and lay people. All of these studies had relatively small numbers of responses compared with this internet survey.

Armbruster and colleagues found that when asked about missing upper lateral incisors, 70% of the general dentists, 76% of the non-orthodontic specialists and 63% of the lay people considered that

prosthetic replacement, rather than orthodontic space closure would produce the best aesthetic result. The findings of this study suggest that this might be an unrealistic expectation when people are confronted with images of the teeth that have actually been treated. Interestingly the orthodontists in the study by Armbruster et al were equally split between recommending orthodontic space closure (51%) and prosthetic replacement (49%).

Highest scoring v lowest scoring images/Highest preference

The image that was considered most attractive was one of OSC with a mean attractiveness rating of 3.8 (95% CI 3.75-3.88) and 69.7% of assessors considering the teeth to be 'Attractive' or 'Very attractive' (Figure 3a). The image that was considered least attractive was of PR with a mean attractiveness rating of 2.1 (95% CI 2.08-2.18) and only 4.8% of assessors considered the teeth to be 'Attractive' or 'Very attractive' (Figure 3b). In the preference section a majority of the assessors preferred the image of OSC in three out of the four pairs of teeth, which is contrary to the findings of Barber and colleagues (Barber et al., 2015), who used digitally manipulated full face images.

Method

The images included in the study were chosen from the records of actual treated patients rather than digitally manipulated images. There is little doubt that the skill of the restorative dentist and technician is a crucial factor in achieving the best aesthetic result, particularly for patients in whom the space is opened and prosthetic teeth placed (Kokich et al., 2011). Images from more than one centre were included, representing the aesthetic outcomes produced by clinicians in both general hospitals and a teaching hospital, increasing the generalisability of the findings. The number of images was kept to a minimum to ensure that the survey completion time was no more than 10 minutes and to lessen the risk that respondents gave up before finishing the survey. This appears to have been successful, because 104 participants (9%) stopped after the demographic section and only 17 (2%) after the attractiveness section.

No attempts at digital manipulation were undertaken (other than cropping), as it was considered that this can sometimes lead to an unrealistic appearance (Barber et al., 2015). Images of just the upper anterior teeth were used to minimise the effects of lips, buccal corridors and other smile components on the participants' aesthetic judgements. This was considered important to eliminate any distractions that might be caused by the appearance of the lower teeth, tooth-size disproportions or occlusal relationships. Colour images were used rather than black and white, as these are more realistic to the lay person; however it is possible that this might have affected the overall judgement of the teeth.

Other studies have used intra-oral photographs to assess the aesthetic perceptions of the smile by lay people (Armbruster et al., 2005a, Robertsson et al., 2010). Armbruster and colleagues (Armbruster et al., 2005a) did not crop their intra-oral images, whereas Robertsson and colleagues (Robertsson et al., 2010) attempted to standardise their images by modifying them slightly with an outline of the lip line. It might be argued that this was not a very realistic intra-oral view, and may have affected the aesthetic judgements of the assessors.

Other studies have chosen to display extra-oral views of the lips and teeth in a smiling pose or even full facial views of the smile to assess aesthetics. Parekh and colleagues (Parekh et al., 2006) digitally morphed smiles with various arrangements of buccal corridors (narrow-wide) and smile arcs (flat, reverse and parallel to lower lip) to evaluate the effects of such variations on the aesthetic judgements of lay people and orthodontists. The images showed only the lips and upper teeth, which was useful to evaluate the buccal corridors and smile arcs; however, the digitally altered images are not without criticism (Barber et al., 2015). The authors might have introduced some extreme presentations of the variables under investigation, which may not exist in a real life scenario and can be considered a distraction to the assessors. A similar methodology was used by Bukhary and colleagues (Bukhary et al., 2007). Other studies have used both frontal facial smiles, three-quarter smiles and extra-oral close up smiles shots to evaluate the perception of aesthetics by judges (Isiksal et al., 2006, Rodrigues Cde et al., 2009) Flores-Mir and colleagues (Flores-Mir et al., 2004) compared different frontal views on the perception of smile aesthetics and found that laypeople are more critical with close up images than with full face frontal or three-quarter views. In this study we were only interested in the differences between the aesthetic judgements of OSC and PR; therefore we believe that the use of dental views, without the face, was justified.

Another possible criticism might be that obtaining a valid and reproducible smiling image on a single photographic image might be difficult (Ackerman and Ackerman, 2002); however Schabel and colleagues (Schabel et al., 2010) have shown that smile assessments undertaken from standard digital photographs are similar to those obtained from a captured digital video clip.

Assessment scale

The attractiveness measure used in this study was based on a 5-point Likert scale. Many previous studies have used a visual analogue scale for aesthetic assessments (Kokich et al., 2006, Kiekens et al., 2007, Martin et al., 2007, Krishnan et al., 2008, Zange et al., 2011, De-Marchi et al., 2014, Meyer et al., 2014, Barber et al., 2015); however the variability and the intra-examiner reliability of aesthetic VAS ratings have recently been questioned (Barber et al., 2015). It has been suggested that due to the highly subjective nature of a VAS they are most appropriate for looking at change within

individuals, rather than between individuals (Wewers and Lowe, 1990). Couper and colleagues (Couper et al., 2006) concluded that when a VAS was used in a web survey the results were similar to other scale types, however assessments using a VAS took longer than the other formats and consequently there were higher proportions of missing data.

The survey used in this study included a section on preference, which allowed the assessors a chance to compare the attractiveness of space closing and space opening images presented in pairs. The pairs were not random, but were based on the rankings of images by orthodontists and restorative dentists, where top ranking images from each category were matched, followed by the second ranking from each category and so on. This ensured that each pair included two comparable images in terms of attractiveness, and avoided matching the most attractive image from one category to the least attractive image from the other category, which would consequently affect the preference decision on attractiveness by the assessor.

An ipsative response format, where the respondent is forced to make a choice from two or more options, has been used previously in this area (Lin et al., 2013, Barber et al., 2015). In psychological research the ipsative style has been used to avoid the potential for central tendency bias with a Likert response format, as respondents avoid the most extreme categories (Baron, 1996, Christiansen et al., 2005). Other potential biases with Likert scales include acquiescence responding, where responders tend to agree with statements and social desirability responding where they try to appear more positive (and occasionally more negative) than they are.

Gender and age of the judge

In the present study, it was found that males were found to be more critical of aesthetics than females. Reports in the literature about differences in gender judgments on dental or facial aesthetics are contradictory. Some studies have shown that females tend to be more critical (Flores-Mir et al., 2004, Kiekens et al., 2007, Kiekens et al., 2008, Zange et al., 2011), whereas other studies have found no significant difference between males and females (Johnston et al., 1999, Flores-Mir et al., 2004, Parekh et al., 2006, Bukhary et al., 2007, Martin et al., 2007, Rodrigues Cde et al., 2009, Chang et al., 2011, Springer et al., 2011, Meyer et al., 2014); however some of these studies have involved samples of just 20 lay participants.

The age of the judge was found not to have an effect on the aesthetic judgements in this study. Again the findings in the literature are contradictory. Some studies agree that age is not a significant factor (Rodrigues Cde et al., 2009), whereas others have found that younger assessors were more critical than older assessors (Flores-Mir et al., 2004, Kiekens et al., 2007, Kiekens et al., 2008).

Dentists v non-dentists/ Patients v non-patients

The data from participants who stated that they were in the dental profession were excluded from the analysis in this study, as we were particularly interested in the views of non-dentists. The literature examining agreement in the aesthetic opinions of dentists and lay people is contradictory; however Cooper and colleagues (Cooper et al., 2012) caution dentists to be more careful about imposing their views concerning aesthetics onto patients, who might have different ideals.

Unilateral v bilateral hypodontia

In the present study only bilaterally missing upper lateral incisors were included in the study; therefore the results might not be helpful when advising patients with just one missing upper lateral incisor. The findings in the literature concerning differences in the aesthetic assessments between unilateral and bilateral missing lateral incisors are equivocal. Some authors have reported differences (Kokich et al., 2006, Robertsson et al., 2010), whereas others have not (Robertsson and Mohlin, 2000, Armbruster et al., 2005a).

Strengths and weaknesses

One weakness of this study could be considered to be the overall low response rate; however this is a recognised characteristic of internet surveys (Yetter and Capaccioli, 2010). The response rate is similar to other web-based surveys (Rosenstiel et al., 2000, Rosenstiel et al., 2004) and the overall number of participants is much larger than any previous survey in this area; however a question does arise concerning the increased risk of nonresponse bias. Groves (Groves, 2006) undertook a review of the literature and found no clear link between response rates and nonresponse bias. In terms of the nature of the survey there is no reason to believe that those who responded to the survey had a significantly different view than those who did not. Nulty (Nulty, 2008) has suggested ways of increasing the response rates for internet surveys including the use of repeat reminder emails to non-respondents and incentives in the form of entering the respondents in a prize draw. Neither of these approaches was available in this study due to the conditions placed by the university on the use of the volunteers e-mail list.

This study did have a higher proportion of female participants than male participants (76% v 24%), which has also been found previously with internet surveys (Yetter and Capaccioli, 2010). The fact that females tended to be more generous with their attractiveness rating compared with males would suggest that the overall attractiveness of the images might have been over-estimated; however we were not concerned about the overall attractiveness ratings, rather the differences between the OSC and PR images. In terms of the preference ratings there was little difference between the genders with 61.4% of female judgements preferring the image of OSC over the image

of PR compared with 58.1% of the male judgements; therefore the preference result is unlikely to change with a more gender-balanced sample.

The lack of standardisation of the images in this study meant that factors such as the smile line, tooth colour, shape and size and quality of the restorative dentistry could have influenced the outcome. Brough and colleagues concluded that the shape, size and colour of the substituted canine can have a significant effect on aesthetic judgments (Brough et al., 2010); however, this study was interested in the participants' perceptions of actual images of teeth, rather than digital manipulations, which, as has been previously been mentioned, also have their limitations. In addition, the survey was web-based and therefore the size of the image viewed by the participant depended upon the size of the screen they were using and this might also have altered the participants' perceptions. Finally, there is the issue of the validity of questions using closed responses, namely were participants actually looking at the feature of interest or some other aspect? This could be the subject of future investigations using qualitative research methods.

Implications for clinical practice

If there is little difference between OSC and PR, in terms of the lay judgements of the aesthetic outcome, then other factors can be considered when treating a young person with both upper lateral incisors that are developmentally absent, including the cost and duration of treatment. The cost of OSC is likely to be considerably less than PR, both during treatment, but also in long-term maintenance. OSC also has the additional benefit that orthodontic treatment can be carried out during early-to-mid adolescence, whereas orthodontic treatment for PR tends to be delayed until mid-adolescence to allow for a short transition to placement of bridges or implants.

Conclusions

- Images of orthodontic space closure and camouflage were considered equally and in many cases more attractive than images of space opening and prosthetic replacement by this large sample of lay people;
- The majority of lay people preferred the appearance of OSC compared with PR;
- Dentists should be cautious about advising patients with missing upper lateral incisors that orthodontic space opening and prosthetic replacement will achieve the best aesthetic result compared with space closure.

Disclaimer statements

Contributors: Salim Quadri was responsible for the study design, collection and preparation of the photographic material, construction of the survey, data collection and interpretation, as well as the writing of the report. Nicola Parkin was responsible for the study design, collection and preparation of the photographic material, data analysis and interpretation, as well as the writing of the report. Philip Benson was responsible for study design, data analysis and interpretation, as well as the writing of the report. All the authors have seen and approved the final report. Philip Benson is the guarantor.

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Tables

Table 1 – The demographic information about the respondents (total = 1141)

		Completed All Survey	Completed Single Image Only	Blank Responses
N		1018	19	104
Gender	Male	242	5	47
	Female	776	14	57
Position at University	Student	738	13	72
	Staff (academic)	87	2	6
	Staff (other)	193	4	26
Age	Mean	28.0	28.3	27.5
	SD	11.4	12.9	11.6
History previous braces?	Yes	464	9	48
	No	554	10	56
Job to do with dentistry	Yes	76	2	5
	No	942	17	99

Table 2 – The frequencies and proportions of attractiveness ratings from the 959 completed surveys of the 10 teeth (total number of ratings 9590)

	OSC		PR	
	N	%	N	%
Very unattractive	72	1.5%	246	5.1%
Unattractive	890	18.6%	1160	24.2%
Neither attractive or unattractive	1642	34.2%	1448	30.2%
Attractive	1695	35.3%	1566	32.7%
Very attractive	496	10.3%	375	7.8%
N	4795		4795	

Table 3 – Descriptive statistics for the mean attractiveness scores from the five OSC images and five PR images (959 respondents). The null hypothesis of the difference within individual respondents between the mean scores was tested using a paired *t* test.

	Mean Attractiveness Rating	SD	95% CI	Difference between means	95% CI of difference	P
OSC	3.34	0.56	3.31-3.38	0.21	0.18-0.24	<0.001
PR	3.14	0.58	3.10-3.18			

Table 4 – Logistic regression where the dependent variable was the respondents’ attractiveness score (neutral scores removed, Attractive and Very attractive combined v Unattractive and Very Unattractive combined).

	Unstandardized		Standardized Coefficients					
	Coefficients		Wald	df	Beta	95% Confidence Intervals		P
	B	S.E.				Lower	Upper	
Participant	0	0	8.89	1	1.00	1.00	1.00	0.003
Treatment (OSC or PR)	-0.50	0.05	89.41	1	0.61	0.55	0.68	<0.001
Gender	0.33	0.06	28.32	1	1.39	1.23	1.57	<0.001
Age	0	0	0	1	1.00	0.99	1.01	0.949
Position at university (staff or student)	0.26	0.08	9.85	1	1.30	1.10	1.52	0.002
History of orthodontic treatment	-0.10	0.05	3.23	1	0.91	0.82	1.01	0.072
Constant	0.43	0.18	5.66	1	1.54			0.017

Figure captions

Figure 1: The 10 post-treatment images of patients with missing upper lateral incisors that were ranked highest in attractiveness by 8 specialists (5 space closing images on the left and 5 space opening images on the right)

Figure 2 – Flow chart showing responses to the survey

Figure 3 - Single images of teeth that were judged to be most attractive and least attractive

3a: The image that was judged to be most attractive was of OSC, with a mean attractiveness score of 3.8 and 69.7% of assessors considered the teeth to be 'Attractive' or 'Very attractive'.

3b: The image that was judged to be least attractive was of PR, with a mean attractiveness score of 2.1 and only 4.8% of assessors considered the teeth to be 'Attractive' or 'Very attractive'.

Figures

Figure 4: The 10 post-treatment images of patients with missing upper lateral incisors that were ranked highest in attractiveness by 8 specialists (5 space closing images on the left and 5 space opening images on the right)



Figure 5 – Flow chart showing responses to the survey

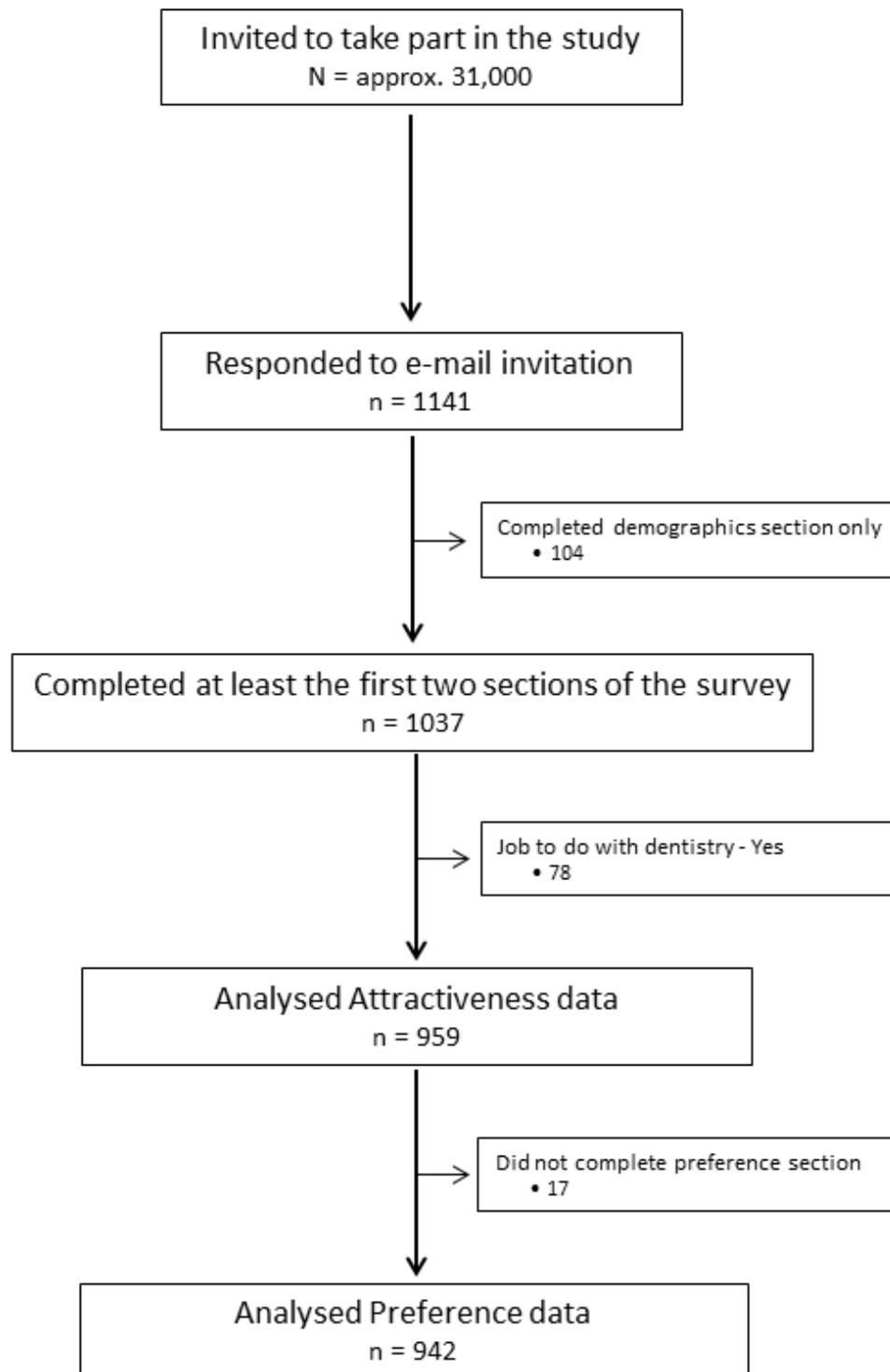


Figure 6 - Single images of teeth that were judged to be most attractive and least attractive

3a: The image that was judged to be most attractive was of OSC, with a mean attractiveness score of 3.8 and 69.7% of assessors considered the teeth to be 'Attractive' or 'Very attractive'.



3b: The image that was judged to be least attractive was of PR, with a mean attractiveness score of 2.1 and only 4.8% of assessors considered the teeth to be 'Attractive' or 'Very attractive'.

