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A Pilot Study Examining the Effects of Enhanced Aesthetics on Oral Health Related Quality of Life and Patient's Satisfaction with Complete Dentures.

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Abstract - *A randomised cross-over study with a validated assessment tool was used to assess patient satisfaction and oral health related quality of life after the delivery of two sets of dentures: one set had an enhanced aesthetics. There was a significant increase in patient satisfaction and oral health related quality of life when baseline data was compared with both types of replacement dentures. Some patients preferred the prostheses with enhanced aesthetics, although all patients reported significantly increased satisfaction with their new dentures; these findings are explored. No difference was seen in the outcome variables between the control and aesthetic dentures and sequence of delivery showed no difference.*

KEY WORDS: *Complete dentures, satisfaction, quality of life, aesthetics*

INTRODUCTION

Twenty years ago it was estimated that around 25 to 35 % of edentulous patients were dissatisfied with their dentures[1-5]. A number of factors which may influence a patient's satisfaction with dentures have been investigated and these have included the technical quality of the dentures [6,7], the quality of the residual ridges and the oral condition [8-11], patient personality and expectations [12-14], socio-economic factors [15], psycho-social factors [16,17] and the relationship between the patient and the dentist [18-20]. Unfortunately, the results from such investigations are often contradictory and provide dentists with little insight into predicting which patients are most likely to present with problems or difficulties with their dentures.

There is a lack of robust information on what may affect a patient's attitude to wearing complete dentures and attempts to relate personality type to levels of morale or self esteem have failed to demonstrate a conclusive link with denture satisfaction [12,13]. It is notable that the authors of these studies acknowledged that the methods for assessing self-image were perhaps too general to detect oral related self-image differences and that there was a need to develop more specific oral or prosthodontic measures of self-esteem [12,13].

It has been recognised that there is a strong correlation between a patient's satisfaction with dentures and other peoples' opinions and comments [16]. As the appearance of dentures is, arguably, the only area that can be assessed by an onlooker it is interesting that the perceptions of others can have a significant influence in patient satisfaction. This finding has been reported elsewhere [17].

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The aesthetic and technical qualities of dentures are intimately associated with the skills of the dentist and the dental technician. Studies that have assessed technical quality as a potential predictor of patient satisfaction are often unclear on how the aesthetic component of technical quality was measured; by its very nature, a clinician's idea of good aesthetics and that of a patient may differ considerably. The clinician may, for example, prefer a natural look in keeping with a patient's biologic or chronologic age and this may be accepted by a patient wishing to disguise the fact that they are edentulous. However, we are all too well aware of patients who will only accept an artificially youthful bright white, regularly aligned tooth arrangement. For these patients a youthful appearance may be more important than disguising their tooth loss. Thus the inclusion of a clinician centred assessment of the technical aspects of achieving an aesthetic denture would appear to have its limitations.

It is hypothesised that alteration of aesthetics will influence a patients' satisfaction with their dentures and consequently influence their satisfaction with the dentures and their oral health related quality of life. The aim of this study was to determine the effect that enhancing denture aesthetics had on a group of edentulous patients' satisfaction with their dentures and their impact on Oral Health Related Quality of Life (OHRQoL) using the Oral Health Impact Profile (OHIP-20)[19]. A secondary aim included an assessment of preferred appearance and defining reasons for any preferences shown.

MATERIALS AND METHOD

This was a randomised cross-over two centre study with the subjects acting as their own control. The study was sponsored by Newcastle upon Tyne Hospitals (NHS Trust) having received ethical approval from the Local Research Ethics Committee. Before being accepted into the study

patients were given the opportunity to evaluate written and verbal information regarding the nature of the research and what their participation would involve. All patients entering the project gave written informed consent. Ten patients of mixed age and gender were recruited consecutively from the undergraduate prosthodontic treatment clinics at Newcastle University, School of Dental Sciences and Cardiff University, School of Dentistry (20 in total between the 2 centres). The inclusion criteria required patients to have at least 5 years of complete denture wearing experience, not to be currently undergoing dental treatment, be able to attend appointments and understand written English. Any patients with a visual impairment were excluded. No patients were included or excluded on the basis of any previous aesthetic concerns or complaints.

Prior to the construction of the new dentures patients completed two questionnaires:-

A patient satisfaction questionnaire using visual analogue scales to determine the patient's satisfaction in a number of areas including denture aesthetics, denture function and denture comfort [18],

An OHIP-20 oral health related quality of life questionnaire [19].

After completing the questionnaires, the patients had their new dentures made using standard conventional techniques. After the vertical, horizontal and antero-posterior jaw relationship stage, the patients were randomly allocated to a sequence for receiving the aesthetic (AD) or control denture (CD) from a randomisation matrix designed by the authors. Once an acceptable 'try-in' had been achieved the master models were duplicated and a second try-in made with the set-up chosen by the patient but otherwise matched with respect to shade, size and shape of tooth mould. Extreme care was taken to make sure that the eventual polished surfaces of the 2 prostheses were duplicated and putty matrices were employed to facilitate this. Denture bases were processed on duplicate master models, and posterior tooth arrangement, width and angle were the same for both sets of dentures.

The aesthetic dentures used teeth that had a more natural range of shade and translucency (Enigma™). When carrying out patient focused tooth arrangement, patients were encouraged to personalise the positioning of anterior teeth and were given photographs of four possible variations in tooth arrangement to act as a visual aid in this process (Figure 1). In addition to characterising tooth position the gingival appearance was enhanced through contouring and stippling of the buccal flange of the dentures.

The control dentures were constructed using the denture tooth normally supplied by the production laboratory within the two hospitals (Cosmo HXL™) and was representative of prosthetic teeth normally used by laboratories working under NHS terms and regulations. These teeth, whilst having an acceptable aesthetic quality, generally lack a natural appearance due to their poorer translucent quality. For these dentures no characterisation in the set up was included and the denture was finished in standard acrylic resin with a smooth polished gingival finish.

After approval of the denture try-ins by the patient and clinician they were processed and delivered in the normal manner.

Patients were reviewed as normal with adjustments being made as and when required. Three months after delivering the dentures a review appointment was made and patients were asked to complete further OHIP-20 and patient satisfaction questionnaires. These questionnaires were not completed with the clinician present but supervised by a dental nurse devolved from the study. Patients' were informed that their ratings would not be seen by the treating clinician. At this visit the alternative denture was delivered and the evaluation process repeated.

At the end of the study patients were asked to state which of the two dentures they preferred and to give reasons for their choice.

ANALYSIS OF DATA

Data were transcribed onto a datasheet by a researcher who was blinded to the group allocation. The statistical analyses were carried out using SPSS™ statistical software utilising the baseline data (with the previous conventional dentures) to assess comparability of the two sets of prostheses delivered to the patients. Mean and standard deviation scores were calculated for each denture type and at baseline for each domain of the satisfaction questionnaire and OHIP-20.

As the data were normally distributed, comparison between baseline scores with each prosthesis design and between the two designs was carried out using paired t-tests. Statistical significance was assumed at the 5% level. A comparison of baseline data for patients who completed the study against those who did not and between Newcastle and Cardiff patients was carried out using unpaired t-tests.

RESULTS

20 patients were recruited to the study (10 from each centre). 16 patients (9 male) completed the study. Of the 4 lost to the study one patient died, two failed to return for their first 3 month review appointment, and the fourth was discharged inadvertently before they could be provided with the control denture.

The baseline demographics of the patients are shown in Table 1. A comparison of the baseline data for all patients recruited against those who completed the study shows that there is no difference in these group of patients at baseline with respect to age, gender, satisfaction with their dentures or OHRQoL as measured by the OHIP-20. There were no statistical differences between the baseline data at the two centres.

Those patients completing the study had a mean age 62.5 yrs (range 27-77), and mean baseline general satisfaction scores of 34.7 ($\pm$ 37.4) and total OHIP-20 scores of 44.8 ($\pm$ 18.9)

The 3 month post- delivery satisfaction for both control (CD) and test dentures (AD) along with the baseline data is shown in Table 2. Both denture types resulted in an increase across all domains of patient satisfaction with the exception of ease of cleaning and ability to speak, where the increase in satisfaction failed to reach a significant level. The 3 month post-delivery OHIP-20 scores for both control and test dentures and baseline data are shown in Table

Figure 1: *Illustrations used to help patients deciding on the aesthetic set-up they wanted.The plan views were used to illustrate tooth irregularities.*

Table 1 - A comparison of the baseline data between the centres and between the patients who completed study and those who did not.

	Baseline Data	*Subjects Recruited*	*Subjects Completing Study*	*Difference*
Newcastle	Number	10	10	-
	Age (mean, range)	63.3 (54-77)	63.3 (54-77)	-
	Gender (M:F)	5:5	5:5	-
	OHIP-20	45.7 ± 19.7	45.7 ± 19.7	-
Cardiff	Number	10	6	-4
	Age (mean, range)	63.0 (27-78)	61.2 (27-76)	1.8 (p = 0.839)
	Gender (M:F)	5:5	4:2	
	OHIP-20	40.2 ± 18.2	43.2 ± 17.1	2.96 (p=0.75)
Whole group	Number	20	16	-4
	Age (mean, range)	63.2 (27-78)	62.5 (27-77)	-0.7 (p= 0.871)
	Gender (M:F)	10:10	9:7	
	OHIP-20	42.9 ± 18.7	44.7 ± 18.24	1.78 (p=0.774)

Table 2 - *Baseline satisfaction scores compared with satisfaction scores for both the aesthetic and the control denture designs (positive values in difference being indicative of an increase in satisfaction).*

	Baseline					
	Mean	*sd*	*Aesthetic denture/ baseline Difference*	*P value*	*Control denture/ baseline Difference*	*P value*
General satisfaction	34.7	37.4	50.9	0.000	50.4	0.000
Ease of cleaning	89.6	13.2	1.2	0.837	0.7	0.854
Ability to speak	73.4	30.9	11.9	0.267	15.9	0.125
Comfort (lower denture)	36.5	38.8	35.3	0.003	39.1	0.001
Comfort (upper denture)	57.5	35.8	33.4	0.004	29.8	0.007
Appearance (lower denture)	50.8	39.1	32.6	0.001	27.7	0.026
Appearance (upper denture)	62.7	33.9	31.8	0.002	20.9	0.054
Stability (lower denture)	31.8	35.9	35.8	0.005	45.0	0.000
Stability (upper denture)	48.1	36.3	43.9	0.000	34.0	0.002
Ability to chew	35.2	34.5	31.0	0.004	35.9	0.004
Oral condition	63.6	33.2	20.7	0.050	13.9	0.322

Table 3 - *Baseline OHIP scores compared with OHIP scores for both the aesthetic and control denture designs (negative values are indicative of an improvement in OHRQoL).*

	Baseline					
	Mean	*sd*	*Baseline/ Aesthetic denture*	*P value*	*Baseline/ Control denture*	*P value*
Total OHIP-20 (0-100)	44.8	18.9	-15.7	0.021	-20.9	0.001
Functional limitation (0-15)	9.3	3.9	-3.4	0.019	-3.7	0.000
Physical pain (0-20)	11.2	4.8	-3.8	0.025	-4.3	0.001
Psychological discomfort (0-10)	5.2	2.4	-1.9	0.019	-2.7	0.001
Physical disability (0-20)	8.9	4.8	-1.7	0.371	-2.9	0.038
Psychological disability (0-10)	4.9	2.3	-2.4	0.015	-2.7	0.002
Social disability (0-20)	3.9	3.6	-2.2	0.008	-1.8	0.063
Handicap (0-5)	1.5	1.3	-0.3	0.535	-0.6	0.029

Table 4 - *Comparison of satisfaction scores between aesthetic and control dentures (a negative value for difference favouring the control denture)*

	Aesthetic Denture		Control Denture			
	Mean	sd	Mean	sd	Difference	P value
General satisfaction	85.6	25.4	84.1	27.3	1.5	0.856
Ease of cleaning	90.8	16.2	90.3	18.8	0.5	0.953
Ability to speak	85.3	24.4	89.3	20.1	-4.0	0.566
Comfort (lower)	71.8	33.4	75.6	27.7	-3.8	0.679
Comfort (upper)	90.9	11.8	87.3	26.08	3.6	0.630
Appearance (lower)	83.4	20.3	78.5	29.8	4.9	0.570
Appearance (upper)	94.5	5.14	83.6	27.6	10.9	0.098
Stability (lower)	67.6	31.3	76.8	28.5	-9.2	0.391
Stability (upper)	92.0	9.9	82.1	25.9	9.9	0.166
Ability to chew	66.2	33.4	71.1	27.8	-4.9	0.640
Oral condition	84.1	26.6	77.5	30.8	6.6	0.550

Table 5 - *Comparison of OHIP scores between aesthetic and control dentures (a negative value being indicative of improved OHRQoL with the control denture)*

	Aesthetic Denture		*Control denture*		*Difference*	*P value*
	Mean	*sd*	*Mean*	*sd*		
Total OHIP-20 (0-100)	29.1	24.3	25.9	22.6	-3.2	0.586
Functional limitation (0-15)	5.9	4.6	5.6	3.5	-0.3	0.691
Physical pain (0-20)	7.4	6.1	6.9	5.2	-0.5	0.766
Psychological discomfort (0-10)	3.3	3.0	2.5	2.6	-0.8	0.618
Physical disability (0-20)	7.2	6.7	6.0	5.4	-1.6	0.336
Psychological disability (0-10)	2.5	3.0	2.2	2.7	-0.3	0.848
Social disability (0-20)	1.7	2.8	2.1	3.6	0.4	0.483
Handicap (0-5)	1.2	1.6	0.9	1.3	-0.3	0.238

Table 6 - *Patient preference and reasons for preference.*

Preferred Denture	*No. of patients*	*Reasons for preference*	*No. of quotes*
Aesthetic	7	i. more natural or attractive appearance	6
		ii. family and friends preferred	1
		iii. increased confidence	1
		iv. felt more involved in the process	1
Control	5	i. looked more like previous denture	2
		ii. didn't like a change	2
		iii. felt more comfortable	3
		iv. whiter	1
No preference	4	Not applicable	

3. Provision of both the aesthetic and control denture resulted in a decreased impact on patients' oral health related quality of life for total OHIP and all domains of OHIP-20 apart from 'physical disability' and 'handicap' where the provision of the aesthetic denture did not significantly alter the OHIP score from that of baseline. In comparing the aesthetic denture with the control denture no differences were observed for the patient satisfaction or impact on oral health related quality of life scores (Tables 4 and 5). Comparison of the outcome variables according to the sequence of delivery failed to demonstrate any statistical difference in satisfaction or OHRQol between the dentures that were delivered first or second (data not shown).

Four of the 16 patients did not express a preference for either denture type, whilst 7 selected the aesthetic prostheses and 5 the control. The reasons given for preference are shown in Table 6.

DISCUSSION

This study was undertaken in order to evaluate whether or not the provision of an aesthetically enhanced denture which the patient had direct involvement in choosing affected outcome as measured with patient centred satisfaction and OHRQoL using an OHIP-20 questionnaire.

Large variations in anterior tooth position or arrangement were avoided in order to minimise variance in the effects that adjacent soft tissues may have on stability and retention of the dentures. As a result the aesthetic differences between the two sets or prostheses were not pronounced; nonetheless, three quarters of the patients were able to clearly distinguish between the appearances of the two sets and state a preference. This may support the hypothesis that denture aesthetics are an important factor in patient satisfaction and acceptance; alternatively it could be argued that this finding may be due to a raised awareness of appearance as a result of participation in the study.

This study was undertaken in two centres in order to facilitate patient recruitment and evaluate the logistics of carrying out such research at different institutions. The long term aim being to investigate the impact of denture aesthetics on patient acceptance of dentures in a large scale multi-centre study in the future. In this pilot study one centre failed to retain 4 of its 10 patients which highlights the issues of patient attrition and the subsequent effect that this may have on the power of a study to demonstrate

significance. It is interesting to note that no statistical difference was seen between those patients who started the study and those were lost to the study with reference to their baseline parameters. The baseline satisfaction scores and OHRQoL did not appear to influence whether or not patients completed the study. It should also be noted that the results showed similarities in the populations between both centres but that in pilot studies such as this, single patient demographics can skew ranges and means.

The large deviations in satisfaction scores reported are in agreement with similar studies using similar protocols and analyses in relation to OHRQoL [23]. Additionally, while 3 months of denture wear may be viewed as a short time in order to assess OHRQoL this period has been used in similar studies looking at fixed and removable implant retained prostheses, allows for a reasonable and acceptable cross over time and prevents study wastage amongst patients [23]. Additionally, the "moral" issue of retaining the patients first delivered prosthesis between stages (i.e. after the 3 month review of the first prostheses) in order to prevent the patient reverting to this prosthesis during the trial of the new one is arguably a point that future similar studies will have to address. Whilst it was understood that no patients reverted to their first delivered prosthesis during the assessment of the second by the participants in this study, it is a fact that such an opportunity exists and that this could influence results.

No difference in patient satisfaction or OHRQoL was seen when comparing between the aesthetically enhanced denture and the control denture. This finding differs to the research of Diehl *et al* who suggested that the very process of establishing agreeable aesthetics calls for the clinician to be engaged in an opinion seeking dialogue with the patient [15]. In itself this demonstration of interactive care may increase the probability of a successful outcome, for although a patient's attitude to treatment may not be a determinant for success, it has been demonstrated that a patient's perception of the quality of care is[15]. In this study there was no difference between the denture types whether or not involvement in the aesthetic set up was undertaken. However the patients' involvement with the study and the provision of care within a school of dentistry could have meant that the patients perceived the quality of care provided as "excellent" anyway. Regardless of the technical quality of treatment the tendency for undergraduates to take longer over individual treatment stages and the involvement of a clinical teacher may have led the patients to the conclusion that the quality of care was greater, and this as suggested by Diehl may have clouded their perception of differences between the 2 prostheses. The lack of differences in OHRQoL and patient satisfaction between the two denture types suggests that aesthetics form only one aspect of the patients overall perception of their dentures and that in this cohort of patients the extent of any preference is not great enough to influence the overall score. However, this may be a reflection on this particular group of patients who having been accepted for treatment by undergraduates did not perhaps represent the most challenging prosthetic cases and certainly did not require specialist care; a group requiring such care may have shown different results. This is supported by comparing the baseline satisfaction and OHIP 20 scores of these patients with other cohorts of patients involved in studies comparing rehabilitation strategies such as implant supported overdentures with conventional dentures [15, 16]. Typically patients involved in these studies have baseline satisfaction scores that are in the region of 50% lower than the patients in this study. Likewise the baseline OHIP scores were lower for this cohort of patients when compared to similar edentulous cohorts in studies comparing implant provision with conventional techniques. If a similar study was carried on a cohort of patients struggling to adapt to denture wearing one could hypothesise that the differences may be more apparent especially if the patient's inability to adapt to denture wearing was linked to an altered body image and lack of self-esteem as a result of a dental clearance.

Another interesting observation is the level of improvement seen in these patients. Lindquist and Carlsson suggest that provision of replacement conventional dentures may only provide a 10% improvement in satisfaction [22], however this cohort of patients typically had over 100% improvement in satisfaction domains of comfort, stability and ability to chew and increases in the region of 40-50% for aesthetics and chewing ability. Once again this may be a reflection of this particular cohort of patients who being chosen, as they were for management by undergraduates, represented on the whole a group of patients who were accepting of dentures.

Perhaps the most significant finding for clinicians is the factors identified by patients as the reason for their final choice of denture type. Those choosing the control denture did so on the basis of maintaining a similar appearance and therefore not wishing to draw attention to change. It is interesting to consider the long term effect of avoiding change within replacement denture aesthetics. For many of the patients in this study their first set of dentures may have been provided whilst the patient was in their 30's or 40's and a repeating pattern of replacement with dentures of a similar appearance would ultimately result in patients wearing and accepting dentures with an artificially youthful appearance rather than managing a changed aesthetic which may draw unwelcome attention. It may also be the case that a significant proportion of these patients peer group may themselves be denture wearers and have an awareness of the oral condition of their friends. For them there may be much less need to disguise their dental state as it carries no stigma and therefore a beautiful youthful smile is aspired to. For those preferring the more aesthetic denture their reasoning was biased towards disguising their edentulous state and whilst the numbers involved in this study are too small to allow a meaningful analysis it would be interesting in future to compare the baseline satisfaction and OHRQoL domains with respect to final preferences. Thus is could be hypothesised that a patient with a high score within the domain of psychological discomfort and a low score for satisfaction with appearance at baseline may be more pre-disposed to a more natural aesthetic denture and more willing to accept and manage change in order to facilitate disguise of their oral condition.

In conclusion, in this group of edentulous patients enhancing denture aesthetics did not affect satisfaction with their dentures or Oral Health Related Quality of Life (OHRQoL). Individual patient's preference was motivated by either wishing to avoid change or disguising their edentulous state. In considering the provision of replacement dentures clinicians should recognise this dichotomy and identify from the patient which is most important to them.

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MANUFACTURER'S DETAILS

- Enigma ™, Davis Schottlander & Davis UK Ltd, Letchworth Garden City, UK
- Cosmo XML™, DeguDent GmBH, Rodenbacher Chaussee 4, D-63457 Hanau-Wolfgang, Deutschland
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