Is the value of oral health related to culture and environment, or function and aesthetics?

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Objective: To examine the disutility of tooth loss. It compared how people value their teeth in two countries which are culturally similar in order to explore the effect of culture on self-perceptions of oral health. **Basic research design**: Cross sectional study. **Participants:** Participants were recruited from subjects attending two hospitals in Turkey and in Iran. **Interventions:** Nineteen descriptions of mouths with varying degrees and types of tooth loss were presented to the participants. They were shown mouth models of partially edentate dentitions and the teeth missing were explained in relation to the participants own mouth. The participants were specifically asked to consider the role their teeth played in function (chewing), communication (speech) and aesthetics (looks) along with "all the other things that make your mouth important" **Main outcome measures:** The participants were asked to indicate on a visual analogue scale how they would value the health of their mouth if they lost the tooth/teeth described and the resultant space was left unrestored. **Results:** Overall 152 subjects participated, 78 in Turkey and 74 in Iran with 83 being female and 69 male. Their mean age was 29.5 years (SD 9.3), 62.5% had experienced tooth loss and 37.5% had complete (or completely restored) dentitions. Although there were no differences between the two countries in the degree of utility people attached to anterior teeth, Turkish participants attached significantly more disutility than Iranians to the loss of premolar and molar teeth ($p<0.003$). **Conclusion:** Country of origin had an influence on the value placed on certain parts of the dentition and this effect is independent of the number of missing teeth, gender and age. This implies that attitudes to oral health are influenced by prevalent cultural attitudes more than by function.

Key words: *teeth, tooth loss, culture, oral health, utility, Turkey, Iran.*

Introduction

Oral health, or lack thereof, when defined normatively is measured in the same way in every country. That is, the amount of disease is quantified and this measure is taken to represent the burden of oral disease in that state or nation (Daly *et al*., 2002). However, in recent years, there has been a paradigm shift suggesting that a more psycho-social construct is relevant to the meaning of health (Locker, 1988). If this posit is accepted, it is no longer sufficient to simply quantify pathology to measure health (or lack of it.) A socio-cultural approach to health measurement accepts that the functional, psychological, social and aesthetic impacts of impairment must be considered and if possible, quantified (Locker, 1989). So, it then becomes necessary to consider the way in which oral health impairment affects the individual. For example, how well a dentition functions in chewing and eating depends to some extent on the diet the person would normally be expected to eat (Sheiham and Steele, 2001). Similarly, the psychological impact of disease depends on an individual's coping mechanisms, their ability to effectively take action to minimize any disability caused by the impairment i.e. in the case of oral disease, the availability of dental services and effective treatment/restoration (Cushing *et al.,* 1986). Finally, the social and aesthetic impact of poor oral health will be related to the expectations of the individual and the society around them, or on the value placed on beauty, and the effect of facial appearance on life chances in their particular culture (Shaw *et al*., 1991). It would therefore be expected that the value placed on a dentition by an individual would be highly dependent on the culture in which that individual existed (Nassani *et al*., 2009). This study explored differences in oral health from the viewpoint of subjectively measured oral health using a method which aligns with modern concepts of health. The method was to examine the disutility of tooth loss in two countries where Islam is the predominant religion and, which have apparently similar cultures (Parhizkari and Kuehnel, 2011).

Turkey is considered to be similar to Iran (Inglehart, 1997) both being Middle Eastern, middle income countries with populations around 77 million. Iran spends 5.7% of its gross domestic product (GDP) on health care and about 90% of Iran's 30 dentists per 100,000 population work in the private sector (Pakshir, 2004). Turkey is more secular than Iran and about half its size. Turkey spends 7.8% of its GDP on health care with a dentist population ration of 38 per 100,000, much higher than the global average. Thus these two relatively powerful and modern countries are similar in many ways, although Turkey is better supplied with dentists (Pekiner *et al*., 2010).

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These particular populations were chosen because, despite their similarities one noticeable difference between the two is their levels of oral health. The mean DMFT in 12-year-olds in Iran in 1988 was 4 and in 2002 85% of young people aged between 6-19 years were affected by tooth decay. In 2007 67% of Iranian people over the age of 65 were edentulous and in those over the age of 18 the mean DMFT is 11. Whilst population based figures for edentulousness in Turkey are not available, more Turkish people retain and maintain their teeth than do Iranians (Pakshir, 2004, Hessari *et al.*, 2007, 2008, Pekiner *et al.*, 2010). This could be either a cause of, or an effect of, the value people put on intact dentitions, i.e. in a culture where tooth loss is not the norm, it might be regarded as having greater impact when it does happen, than in a culture where tooth loss is relatively common. Alternatively, it could be argued, that if people do not value their teeth highly they are more likely to suffer tooth loss, and more likely to find extractions as acceptable as restoration when problems arise. If we are to address oral health inequalities it is very important to understand the extent to which social norms affect the value placed on oral health

This study therefore aimed to examine the disutility of tooth loss among two populations which are culturally similar but who have different levels of oral health care, dissimilar levels of tooth loss in the population and different levels of treatment provision (Kiadaliri *et al.*, 2013).

The concept of utility refers to the level of "desirability that people associate with a particular outcome" (Rohlin and Mileman, 2000) with utilities defined as "numbers that represent the strength of a person's preference for particular outcome when faced with uncertainty".

The study was carried out because we wished to determine whether the loss of teeth was valued differently in the two countries and whether this was more strongly influenced by the country/culture of the person, or by their current levels of tooth loss. The hypothesis tested in this study was therefore: Are patients' oral health expectations and values a function of current disease levels (tooth loss) or cultural context. Exploring this hypothesis may help our understanding of how these variables affect demands on dental health services.

Method

The protocol of this study was approved by the Research Ethics Committee of Faculty of Dentistry, University of Gaziantep, Gaziantep, Turkey and the Vice Chancellor of Research of Kerman University of Medical Science, Kerman, Iran.

A research assistant at the reception desk of Gaziantep dental hospital and the outpatient clinic of Kerman Dental School invited patients and their companions to take part in the study. The invited subjects were informed that they could not participate if they were completely edentulous or wearing complete dentures. An information leaflet was provided and the research assistant further explained the purpose of the study and gave volunteers a consent form. Participants were assured that the clinician treating them would not be informed of participation or otherwise, nor would they know their responses to the questions posed. Those who signed the consent form became participants then the research assistant arranged an interview appointment.

At the start of the interview, participants recorded their age, gender, whether they had ever lost any of their permanent teeth and if they now had any unrestored dental spaces. The questionnaire also gave 19 scenarios for mouths with missing teeth: 14 mouths with one missing tooth, five with shortened dental arches (SDAs) of varying lengths. Figure 1 presents an example scenario. A verbal explanation and images of mouth models with missing teeth accompanied each written description. A face mirror was also used to illustrate to each participant the position of the lost tooth/teeth in his/her own mouth and a plastic mouth model was available as an aid to understanding which teeth were lost.

Table 1. The 19 tooth loss scenarios used in this study

1	Missing upper right central incisor
2	Missing upper right lateral incisor
3	Missing upper right canine
4	Missing upper right first premolar
5	Missing upper right second premolar
6	Missing upper right first molar
7	Missing upper right second molar
8	Missing lower right central incisor
9	Missing lower right lateral incisor
10	Missing lower right canine
11	Missing lower right first premolar
12	Missing lower right second premolar
13	Missing lower right first molar
14	Missing lower right second molar
15	Shortened dental arch with missing second molar teeth (upper and lower)
16	Shortened dental arch with missing molar teeth (upper and lower)
17	Shortened dental arch that extends from the second right premolar to the first left premolar
18	Shortened dental arch with missing molar and second premolar teeth (upper and lower)
19	Extreme shortened dental arch with missing molar and premolar teeth (upper and lower)

Let us suppose that you have lost your **upper right central incisor** (as shown in the picture), but you don't have any problems with your remaining teeth. **Thinking about how you chew, speak, look, and all the other things, which make your mouth important**, please mark on the line below (with a vertical line) how you would value the health of your mouth if you had had this space unrestored.
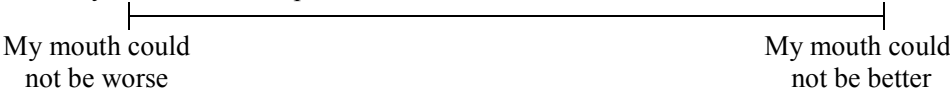
My mouth could not be worse   My mouth could not be better

Figure 1. *The visual analogue scale and image of a mouth model for one tooth loss scenario*

All single tooth loss scenarios were only for the right side of the mouth. An assumption was made that loss of teeth on the left and right sides of the mouth would have the same impact on how a person perceived their oral health and hence equal utilities. For SDA scenarios, the illustrations showed both sides of the mouth. Table 1 lists the study's tooth loss scenarios.

To measure the disutility for each scenario, participants were asked how they would value the health of their mouth if they had lost the tooth/teeth described and the resulting space was left unrestored and to indicate this with a mark on a standard 10cm visual analogue scale with endpoint anchors were: 0, my mouth could not be worse; 1, my mouth could not be better (Figure 1). The distance of the mark from the left-hand side of the scale, in centimetres, divided by ten, was the utility score ranging up to unity for full health which is the convention in utility measurement (Petitti, 2000).

Visual analogue scales have been shown to have good intrarater and interrater reliability (r=0.70-0.94, r=0.75-0.77 respectively). Test–retest reliability is also greater for rating scales than for other methods of utility measurement, such as standard gambles or time trade-offs (Froberg and Kane, 1989). For these reasons and because it is easily understood by patients (Fyffe et al., 1999) this scale was chosen for utility measurements.

The 19 scenarios of tooth loss were prepared in English and translated into Turkish and Persian. Visual aids in the form of photographs and models along with each scenario were intended to aid subjects in understanding the task. At both sites an interviewer was available to assist participants should they have difficulty in understanding what was required of them and to clarify any concerns in the use of the rating scales. These interviewers (RO and TMM) were trained in the use of the research processes by the first author (MZN) who developed the original method (Nassani and Kay, 2011). To avoid any ordering effects on the ratings given, the order in which the different scenarios were presented was changed for each participant.

The utility values for each tooth loss scenario were derived by calculating a simple mean for each of the two samples. Independent samples t-tests compared samples. Bonferroni's multiple test correction was applied making p-values <0.003 significant differences between groups (0.05/19). The mean ages of samples were also examined using t-tests. Differences in gender and dentition status were examined using chi-square tests.

Mean utility values were also calculated for loss of anterior teeth, all premolar teeth and all molar teeth along with mean values for loss of these tooth types in the upper and lower arches. Here in t-tests p<0.006 (0.05/9) denotes a significant difference. To control for the potential confounding effects of gender, age and dentition status a series of linear regression analyses were undertaken with the individual utility value being the dependent variable and the independent variables being the potential confounders along with a binary variable denoting the sample (0, Turkey; 1, Iran).

Results

Some 152 people participated in the study, 78 Turkish and 74 Iranian. There were more females than males in the combined sample (83 vs 69). The mean age of all participants was 29.5 years (SD 9.4). Most, 62.5%, had experienced tooth loss and had unrestored dental spaces at the time of the interview, while 37.5% had full dentitions (either completely natural dentition or with restored dental spaces). The Turkish and Iranian samples were similar with respect to gender though the Iranian group was slightly older (p<0.001) and more likely to have unrestored dental spaces (Table 2).

Table 2. Characteristics of the two samples

	Turkey (n=78)	Iran (n=74)	p value
Gender:			
Male	52.6%	37.8%	0.068
Female	47.4%	62.2%	
Mean age, years	25.5	33.7	**<0.001**
Dental status:			
Fully dentate/ Restored dental spaces	67.9%	5.4%	**<0.001**
Unrestored dental spaces	32.1%	94.6%	

Significance level P<0.05

Table 3 indicates that in both samples missing central incisors had the lowest utility values with values increasing progressively as the tooth lost moved from the anterior to the posterior of the mouth. This was the case for both the upper and lower dentition.

Utility values for SDA scenarios declined with increases in the number of missing posterior teeth. In the Turkish sample a mouth missing only the second molars had a utility value of 0.21, while the most extreme SDA in which all molars and premolars were missing had a value of 0.08. For the Iranian sample the values were 0.33 and 0.10, respectively (Table 3). When the samples' utility values were compared, there were differences for six of the 19 scenarios; for upper 2nd premolar, upper 1st molar, lower 1st molar, SDA with missing molar teeth, SDA extending from right 2nd premolar to left 1st premolar and SDA with missing molar and 2nd premolar teeth. In all these six scenarios Turkish subjects were more concerned by tooth loss than the Iranians.

In the regression analysis, the country of origin of the participants was a significant predictor of utility value after controlling for gender, age and dentition status. The regression coefficients were all negative, indicating that Iranians valued the presence of teeth less than the Turkish people even if they had the same dentition status, gender and age. When the two samples were pooled, there were no differences in the disutility of tooth loss according to gender or dentition status (p>0.003).

Table 3. Comparison of mean (SD) utility values for the two samples

Tooth loss scenario	Turkey (n=78)	Iran (n=74)	p-value
Upper central incisor	0.06 (0.11)	0.06 (0.08)	0.574
Upper lateral incisor	0.10 (0.15)	0.15 (0.16)	0.058
Upper canine	0.14 (0.16)	0.22 (0.18)	0.004
Upper 1st premolar	0.17 (0.18)	0.25 (0.17)	0.006
Upper 2nd premolar	0.21 (0.19)	0.33 (0.20)	**<0.001**
Upper 1st molar	0.20 (0.22)	0.32 (0.26)	**0.002**
Upper 2nd molar	0.28 (0.26)	0.39 (0.27)	0.010
Lower central incisor	0.10 (0.16)	0.07 (0.11)	0.110
Lower lateral incisor	0.12 (0.15)	0.10 (0.11)	0.495
Lower canine	0.13 (0.14)	0.15 (0.13)	0.344
Lower 1st premolar	0.15 (0.16)	0.20 (0.14)	0.026
Lower 2nd premolar	0.20 (0.20)	0.26 (0.16)	0.035
Lower 1st molar	0.20 (0.22)	0.31 (0.20)	**0.002**
Lower 2nd molar	0.25 (0.23)	0.36 (0.23)	0.003
SDA with missing 2nd molar teeth	0.21 (0.26)	0.33 (0.27)	0.005
SDA with missing molar teeth	0.12 (0.17)	0.25 (0.18)	**<0.001**
SDA extending from right 2nd premolar to left 1st premolar	0.10 (0.17)	0.19 (0.14)	**<0.001**
SDA with missing molar and 2nd premolar teeth	0.09 (0.15)	0.18 (0.14)	**<0.001**
SDA with missing molar and premolar teeth	0.08 (0.15)	0.10 (0.16)	0.304

Bonferroni corrected $P<0.05/19 = 0.003$

Table 4 shows participants' mean utility values for mouths with various tooth loss scenarios according to tooth type. In both samples missing anterior teeth attracted the lowest utility values while missing molar teeth attracted the highest utility values. However, the Iranian sample rated loss of premolar/molar teeth significantly higher than the Turkish sample.

Table 4. Mean utility values (SD) for mouth health state according to type of teeth lost

Tooth type	Turkey (n=78)	Iran (n=74)	p
Anterior teeth	0.11 (0.13)	0.12 (0.08)	0.376
Premolar teeth	0.18 (0.15)	0.26 (0.12)	**0.001**
Molar teeth	0.23 (0.22)	0.34 (0.14)	**<0.001**
Upper anterior teeth	0.10 (0.13)	0.14 (0.11)	0.045
Upper premolar teeth	0.19 (0.16)	0.29 (0.17)	**<0.001**
Upper molar teeth	0.24 (0.23)	0.36 (0.24)	**0.002**
Lower anterior teeth	0.12 (0.14)	0.11 (0.10)	0.619
Lower premolar teeth	0.17 (0.17)	0.23 (0.15)	0.023
Lower molar teeth	0.22 (0.22)	0.33 (0.21)	**0.002**

Bonferroni corrected $P<0.05/9 = 0.006$

Within each sample mouths with missing anterior teeth had lower utility values than mouths with missing premolars and missing molars (all $p<0.001$). Only in the Iranian sample and overall did mouths with missing premolars attract lower utility scores than those with missing molars (both p<0.001).

There were no differences between the opposing pairs of teeth when comparisons were made between missing upper and lower anterior teeth, missing upper and lower premolars, and missing upper and lower molars. This was the case for each sample and across all participants.

Analysis of mean values masks the variation in utilities applied to different tooth loss scenarios. Table 5 shows the distribution of values for a missing upper central incisor and a missing lower second molar within each of

the samples. While values clustered towards the 0 end of the scale for missing upper central incisors, they were more dispersed for missing second molars. This is also reflected in the standard deviations of the mean utility values (Table 3). These increase as the missing tooth described in the scenario moves from the anterior to the posterior aspect of the mouth. There is also a suggestion of greater variability of values in both samples for the posterior teeth as indicated by slightly larger standard deviations.

Table 5. Distribution of utility values for missing upper central incisors and lower second molars in the two samples (%)

Utility value	Turkey (n=78)		Iran (n=74)	
	Upper central incisor	Lower second molar	Upper central incisor	Lower second molar
0	15.4	3.8	62.2	14.9
0.01-0.2	78.2	46.2	35.1	17.6
0.21-0.4	3.8	30.8	2.7	36.5
0.41-0.6	0	11.5	0	17.6
0.61-0.8	2.6	2.6	0	13.5
0.81-1.0	0	5.1	0	0

It is also evident from examining the distributions of the utilities that a minority of the population investigated, valued all teeth almost equally and a minority placed a low value on all teeth including the anteriors. For the majority, however, different values were attached to different teeth depending upon their location in the mouth.

Discussion

It is important to note that the participants in this study (university hospital patients) may not be typical of the general populations of Iran or Turkey. However, the samples are comparable as both are university hospitals in affluent areas and the recruitment methods were identical. These clinical settings were purposively selected to secure participants

with a range of tooth loss who may or may not have been offered treatment to restore the spaces created by that loss as it is generally accepted that utility measurements are best carried out among the people who have experienced the problem being evaluated (Petitti, 2000). The method used in this study has been demonstrated as empirically valid in that utility values measured in this way align with the way people behave in reality in relation to their willingness to have anterior and posterior teeth restored, and their acceptance of a shortened dental arch (Nassani and Kay, 2011).

The findings indicate that the two groups value the loss of anterior teeth in a similar way, but that the Turkish population feel that the loss of molar teeth is more damaging to the value of the dentition than the Iranians do. The difference becomes particularly noticeable when multiple tooth loss in the premolar and molar region is considered. There was a stark and highly significant difference between the two populations in their perception of the value of a dentition with a shortened dental arch. This is interesting, given that 95% of the Iranian sample had unrestored dental spaces, compared to 32% in the Turkish sample having what would usually be considered as a need for prosthetic replacement. The Iranian population was also slightly older. However, the observed differences remained after controlling for age.

The utility values obtained from these Turkish and Iranian samples showed less similarity to each other than previous data comparing dental health state utilities of UK and Iranian populations (Nassani et al., 2009). This is a little surprising as the Iranian and Turkish populations would generally be expected to be more alike, than UK and Iranian people. In that comparison between UK and Iranian people the utility values differed for anterior teeth. In the current study, the differences were only for posterior tooth loss. These findings could be interpreted as evidence that two of the attributes which contribute to the value of a dentition, namely aesthetics and function, contribute to the value of the dentition in different ways in different cultures/countries. Given that the value of the posterior dentition relates largely to function rather than aesthetics, it would seem, from the results presented, that the Turkish population value the functional aspects of the dentition differently to their Iranian counterparts and yet, the two populations appear to value the aesthetic aspects of the dentition in a similar way. Thus, the population differences in utility valuation of the dentition would appear to have more to do with oral health considerations than culture (aesthetic values tend to be culturally driven, whilst the ability of the dentition to function when impaired is not). Nassani et al., (2009) previously suggested that aesthetics might contribute more to mouth utility in women, whilst function might be more equally weighted between men and women, but this study's regression analysis, revealing no gender difference, does not support this view. So it seems that observed differences in this study's functional values of the dentition were caused by cultural and not gender differences.

Utilities are numerical descriptors of the value of a given health state to an individual. The utility measurement scale used specifically asked the participants to consider the role of their teeth in function (chewing) , communication (speech) and aesthetics (looks) along with "all the other things that make a mouth important" when they were assigning the utility values to each tooth loss scenario. It seems from this study that the importance people assign to chewing ability varies from country to country, whilst the impact of the dentition on aesthetics does not, at least for the two countries studied.

However, given the differences in the availability of dentists and dental restorations in the two countries, and the differences in the two samples' prevalence of unrestored dental spaces, we hypothesize that the availability of dentists and dentistry plays a role in a population's attitude to tooth loss, at least in the posterior segments' functionally, rather than aesthetically, important parts of the mouth.

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