EVALUATION OF DIRECT CORONAL TOOTH RESTORATIONS FOR QUALITY AND PATIENT SATISFACTION IN PUBLIC DENTAL CLINICS, DAR ES SALAAM TANZANIA

By

Severine N Anthony

A dissertation/Thesis Submitted in (partial) Fulfilment of the Requirements for the Degree of
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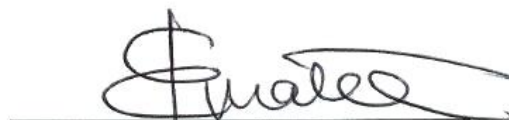Muhimbili University of Health and Allied Sciences

Muhimbili University of Health and Allied Sciences
October, 2010

CERTIFICATION

The undersigned certify that they have read and hereby recommend for examination the dissertation entitled **"Evaluation of direct coronal tooth restorations for quality and patient satisfaction in public dental clinics, Dar es Salaam Tanzania."** in fulfilment of the requirements for the degree of Master of Dentistry (Restorative Dentistry) of Muhimbili University of Health and Allied Sciences.

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I, **Severine N Anthony**, declare that this **dissertation** entitled "**Evaluation of direct coronal tooth restorations for quality and patient satisfaction in public dental clinics, Dar es Salaam Tanzania.**" is my own original work and that it has not been presented and will not be presented to any other university for a similar or any other degree award.

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ABSTRACT

Background

Evaluation of quality of restorations provided to Tanzanians has never been done hence standards of the restorations remains unknown. Patient satisfaction with restorations which is an important aspect of quality of care assessment has also never been done. To ensure quality restorative care is provided it is mandatory to assess quality of restorations as well as patient satisfaction with restorations received.

Objective

To evaluate quality of direct coronal restorations and determine patient satisfaction with the restorations placed at dental clinics within Dar es Salaam city.

Material and methods

A cross sectional study was conducted between June and December 2009 at Muhimbili National Hospital (MNH), Mwananyamala, Temeke, and Mnazi mmoja dental clinics. Modified USPHS Ryge 1980 criteria and patient satisfaction questionnaire were used to assess technical quality of the restorations and patient satisfaction, respectively. Quality of restorations and patient satisfaction data was analysed using SPSS version 14 program.

Results

A total of 200 patients with majority being females (71.5%) were enrolled. The participants had 516 direct coronal restorations of which 48% were amalgam restorations. Sixty three percent of the examined restorations were of acceptable quality. The most frequent reason for unacceptable restorations was colour mismatch (45.7%) followed by restoration overhangs (26.0%) and faulty contact point (22.7%). Secondary caries and apical periodontitis were found on 10.5% and 7% of the restorations respectively. Sixty six percent of patients were satisfied with their restorations with older patients (above 50 years) more satisfied than younger patients.

Conclusion

Generally most of the restorations were of acceptable quality. Colour mismatch was the most common reason for unacceptable restorations both by clinical assessment and patient's opinion during interview. Majority of the patients were satisfied with their restorations.

RECOMMENDATIONS

Dental practitioners should ensure proper colour match when undertaking anterior restorations to improve patient satisfaction. In view of the incoming curriculum review at MUHAS, emphasis should be stressed on anterior restorations especially on shade selection as the most common reason for unacceptable restoration was colour mismatch. Proper use of matrix system eg tofflermier matrix for proximal restorations should be emphasised to avoid restoration overhangs and restore contact. Evaluation of restorations for quality and patient satisfaction should be done regularly to identify areas needing improvement.

TABLE OF CONTENTS

ACRONYMS

USPHS	United States Public Health Services
CDA	California Dental Association
MNH	Muhimbili National Hospital
SPSS	Statistical Package for Social Sciences
MUHAS	Muhimbili University of Health and Allied Sciences
MDent	Master of Dentistry
COHU	Central Oral Health Unit

LIST OF TABLES

LIST OF FIGURES

DEDICATION

This dissertation is dedicated to

my father,

Late Dr Leo K Nyerembe

and my mother

Grace Nyerembe.

ACKNOWLEDGEMENTS

1.0 INTRODUCTION AND LITERATURE REVIEW

1.1 Background

The term "dental restoration" applies to any filling, inlay, crown, fixed partial dentures, removable partial denture, or complete denture that restores or replaces lost tooth structure, teeth, or oral tissues. A coronal restoration/filling replaces a part of or the entire anatomical crown of a tooth and can be direct or indirect. A restoration is categorized as *direct restoration* when it is prepared for immediate application to the tooth/cavity or *indirect restoration* when it is prepared on a model (usually in a laboratory) and later applied to the tooth/cavity. Lesions involving the tooth structure are most commonly located on the anatomical crown of the tooth (coronal) and occasionally involve the root (e.g. root caries). Root caries is common among old adult patients with gingival recessions (Papas et al., 1992).

A restoration (filling) is supposed to be of a good quality so as to effectively serve the purpose to which it is designed which include; to improve the integrity of remaining dental tissue and oral tissues and imitate the form, function and properties of tooth to the patient's satisfaction over time (Jockstad et al., 2001).

Poor quality of restorations reduces restoration longevity resulting into replacement cycle, causing unnecessary loss to patients not only in terms of cost of treatment but also due to time lost by attending dental clinics for refilling. In dental practice replacements comprise about 60 % of all operative work done, consequently a substantial part of dentist's time is allocated to replace dental restorations (Mjör, 1989). Replacement of a restoration costs at least as much as the initial restoration and probably more because of sequential loss of tooth substance hence increasing financial burden to patients and the government (Elderton, 1983).

:tion is an individual patient appraisal of the extent to which the care provided has met ones expectations and preferences (Brennan, 1995). It is a mult-displinary concept involving technical quality of care (process of diagnosis and treatment), interpersonal relationship, accessibility/availability, cost, continuity of care, facilities, and general attitudes about overall care (Anna, 2001). It is important to assess patients' satisfaction as it is both a contributor to health outcomes and an outcome measure on its own right (Corah n et al., 1984;

Chapco et al., 1985: Jockstad et al., 2001,). It influences patient compliance with medical advice, service utilization, and clinician patient relationship (Michel et al., 2007; Zimmerman, 1986). As with every organization that is concerned with satisfying the users of its products or services, dental service providers are becoming more involved with patient satisfaction. This is due to increased evidence that there is association between satisfaction and patient compliance and success of the treatment determines the quality of health care (Brennan, 1995, Newsome et al., 1999).

Technical quality of a restoration can be evaluated using different methods, including United States Public Health Services (USPHS) Ryge, California Dental Association Criteria (CDA) or modified versions of these criteria (Sarrett 2005; Raskin, 1999). The United States Public Health Services (USPHS) evaluation system, also known as Ryge's criteria, is the most commonly used direct method for quality control of restorations (Sarrett 2005; Raskin, 1999; Ryge, 1980). The criterion employs the use of visual inspection with mirror to assess for colour match, cavosurface margin discoloration, marginal adaptation, anatomical form, surface texture and secondary caries (Appendix 3). Modified USPHS uses additional criteria including parameters such as postoperative sensitivity, fracture, interproximal contact, occlusal contact, and others. The combinations of the original and modified USPHS criteria now have been accepted worldwide but are not necessarily uniformly applied. (Bayne and Gottfried, 2005).

Patient satisfaction can be evaluated using a questionnaire based on Likerts scale. In this study a 5 point Likerts scale has been used to assess patient satisfaction with their restorations.

1.2 Review of Literature

1.2.1 Quality of restorations.

Quality of coronal restorations has been studied by several authors worldwide (Vilma et al., 2005; Froze et al., 1990; Homez et al., 2002; Kirkevang et al., 2000;) and in developing countries (Udoye and Okechu 2009; Oginni and Olusile, 2002; Sikri et al., 1993). Homez and colleagues (2001) at Ghent University dental school in Belgium found 75% of the coronal restorations were clinically acceptable and radiographic evaluation revealed 78.1% of restorations in acceptable condition.

Microleakage at tooth /restoration interface is a major factor influencing the longevity of dental restorations. Poor marginal integrity predisposes to early restoration failure mainly due to secondary caries development (Krooze et al., 1990). Unacceptable marginal integrity of 40% was reported in Lithuania (Vilma et al,. 2005).

Unacceptable surface quality has been reported as the least reason for poor quality of restorations needing replacement (Vilma et al., 2005).

A survey of amalgam restoration in Nigeria revealed restoration bulk fracture as a main reason for restoration failure accounting for 47.1% of failure restorations (Ogini and Olusile 2002). Secondary caries usually occur at the interface of tooth and restoration and clinical studies shows more than 50% of replacement of restorations is due to secondary caries (Wilson et al 1997; Pink et al., 1994). This observation was apparent in most studies except some few studies in which poor anatomic form was the principal reason for restorations failure (Vilma 2005; Mjör 1981).

Restoration overhang is a ledge of filling material extending beyond the anatomical shape of a tooth. Overhangs cause an increase in plaque formation and shift in microbial composition from health to one characteristic of periodontal diseases (Jansson et al,.1994; Kells and Linden, 1992). Apart from inflammation direct damage occurs by impingement on interdental embrasure. Most studies reviewed reported higher proportions of restorations with margin overhangs ranging from 18% to 87%% (Chang and Chung, 2009; Mathews and Tabech, 2000; Sikri and Sikri. 1993; Hakkarainen and Ainamo 1980; Coxhead et al.1978; Bjorn et al. Teeth with unacceptable coronal restorations are affected more with apical periodontitis as compared with teeth with acceptable restoration (Kirkervang et al., 2000, Trostad et al., 2000; Siqueira et

al., 2005; Georgopoulou et al., 2008). Restorative material type has influence on apical periodontitis as composite restorations exhibits statistically significant (p<0.01) apical periodontitis (40.5%) as compared to amalgam restorations (28.4%) (Kleuren et al., 1994).

1.2.2 Patients satisfaction with restorations.

Dental health care providers worldwide are showing increasing concern for patients' satisfaction with the aim of responding appropriately to their needs when seeking to improve the quality of the services (Bamise et al., 2008). Most of the literature on patient's satisfaction address patients' satisfaction with dental care, (Stege et al., 1986; Ntabaye MK et al., 1998; Newsome et al., 1999; Matee et al., 2006; Michel et al., 2007; Kikwilu et al., 2009) with some of them comparing satisfaction according to type of service offered (Buthaina et al., 2003). Shalan (2006) shows satisfaction with restorations among patients was moderate (69%). Almost half of those dis-satisfied (47.5%) was due to the non-acceptance of the colour and/or shape of the tooth. Postoperative sensitivity constituted over one third of the subjects' reasons for dissatisfaction with their restorations (Shalan 2006).

In Tanzania quality of direct coronal restorations and patient satisfaction with the restorations provided has never been assessed. Quality of the restorations and patients satisfaction remains unknown, this study is therefore aimed at evaluation of direct coronal restorations for quality and patient satisfaction in public dental clinics, Dar es Salaam Tanzania.

2.0 STATEMENT OF THE PROBLEM

Provision of restorative care in Tanzania is performed at different levels of oral health care system by both public and private clinics. Evaluation of quality of restorations performed has never been done hence standards of restorations remains unknown. Observation of patients attending Muhimbili National Hospital (MNH) restorative clinic during daily practice shows a number of patients complaining of pain, postoperative sensitivity, food impaction or dislodged fillings. This raises questions on quality of the restorations. Furthermore patient's satisfaction with the restorations provided which is an important aspect of quality of care has also never been assessed. This study is therefore aimed at evaluating quality and patient satisfaction with the restorations among patients attending dental clinics in Dar as Salaam city.

4.0 STUDY OBJECTIVES

4.1 Broad Objective

To evaluate, clinically and radiographically, the quality of direct permanent tooth coronal restorations and satisfaction with the restorations among patients attending public dental clinics in Dar as Salaam city.

4.2 Specific Objectives

4.2.1 To determine, *clinically* the quality of direct permanent tooth coronal restorations in terms of surface quality, anatomical form and marginal integrity by tooth type, restoration class and material used.

4.2.2 To determine *radiographically*, the quality of direct permanent tooth coronal restorations in terms of development of apical periodontitis and secondary caries by tooth type, restoration class and restorative material used.

4.2.3 To determine patient satisfaction with the coronal tooth restorations by age, sex, education and restoration experience.

5.0 HYPOTHESIS

5.1 The quality of direct coronal tooth restorations is of acceptable professional standards regardless of tooth type, restoration classes and restorative material used.

5.2 Patients who received restorative care in Dar as Salaam clinics were satisfied with the restorations.

6.0 MATERIAL AND METHODS

6.1 Study design

A cross sectional study based on clinical examination and radiographic assessment of *quality of direct permanent tooth coronal restorations* and *patient satisfaction* with the restorations

6.2 Area of study (setting)

The study was conducted in four dental clinics located in Mwananyamala, Temeke, Mnazi mmoja and Muhimbili National Hospital (MNH).

6.3 Study population and participants

The study population included adult patients with one or more direct coronal restorations who attended public dental clinics in Dar as Salaam city (Tanzania) from August to December 2009.

6.4 Sample size and sampling

Sample size was calculated using the formula $n = z^2 \dfrac{P\,(1-P)}{e^2}$

Where n= sample size

$\qquad$ P= prevalence of unacceptable restorations obtained during pilot study = 49%

$\qquad$ e = maximum error = 0.05

$\qquad$ z= 95% confidence interval standardizeddeviate = 1.96

$$n = \frac{1.96^2 \times 0.49(1-0.49)}{0.05^2}$$

n = 384 = adding 10% of estimated sample size = **423** filled teeth.

The prevalence used (P=49%) was obtained from a pilot study which involved 50 patients attending Muhimbili National Hospital dental clinics in June 2009.

6.5 Selection and inclusion criteria for study participants

6.5.1 Inclusion criteria

The patient with one or more direct coronal restoration(s) on permanent teeth placed in clinics within Dar as Salaam city.

6.5.2 Exclusion criteria

1. Tooth wear or bruxism patients as the restorations are subjected to parafunctional forces.
2. Patients whose restoration(s) were not examined both clinically and radiographically for any reason (refusal to participate fully).
3. Temporary fillings (zinc oxide eugenol)

6.6 Data collection and management

6.6.1 Quality of restorations

Data collection was done one examiner at all collection sites. Intra-examiner reproducibility was assessed by examining every 20th participant twice.

The USPHS Ryge criteria 1980 (Appendix 2a), was modified to suite the objectives of the study and used to assess the technical quality of the restorations (Appendix 2b). The modifications included addition of clinical features such as irritation to soft tissue, contact point, gingival marginal contour and fracture of restoration or tooth or both which are not in the original Ryge 1980 criteria. Clinical examination by visual inspection and probing, followed by radiographs was done for every restoration. Restorations were examined for three clinical features i.e. surface quality, anatomical form and marginal integrity. Each clinical feature had three elements as shown in clinical-radiographic data collection form (Appendix 2c). Every clinical feature element had scores (ranking) 1 to 3 of which 1 stands for excellent, 2 for satisfactory and 3 for unacceptable restorations. Scores 1 and 2 were categorized as acceptable restorations and 3 unacceptable. Radiographic examination was done to determine the presence or absence of secondary caries and or apical periodontitis. Periapical radiographs were taken using Kodak Ekta speed films utilizing bisecting technique and thereafter

processed according to manufacturer's instructions. Reading of periapical radiographs was done under standardized condition using constant light source from a radiograph-viewer (Periomat radiograph viewer). Quality of restorations findings were recorded in a clinical-radiographic data collection form (Appendix 2c).

6.6.2 Patient satisfaction

Patient satisfaction was assessed by interviewing every patient using a questionnaire translated in Swahili language (Appendix 3b). The questionnaire was constructed with the help of 50 patients with restorations attending restorative dental clinic at Muhimbili national hospital June 2009. The patients were asked to list reasons which make them being satisfied or dissatisfied with their restorations. Merging of similar reasons was done and the reasons were listed in descending order based on their frequency of occurrence as follow; spontaneous pain, colour match, appearance, sensitivity, pain during chewing, ability to use filled side, cost of filling. The questionnaire was pre tested for meaning and clarity among 50 patients included during the pilot study at Muhimbili National Hospital dental clinic. The same questionnaire was administered twice to test for reliability. Five items enquiring on patient satisfaction with colour match, appearance, ability to chew, cost of filling and general satisfaction were measured on five-point *Likert scale* (1=very dissatisfied 2=dissatisfied 3=neutral 4= satisfied 5=very satisfied) and the remaining 6 items had yes or no options (1= yes and 2= no).

Frequency distribution of participants according to level of satisfaction (very dissatisfied to very satisfied) were computed and then recoded into different variables into three groups as (dissatisfied, neither/ nor dissatisfied and satisfied). Also the data was dichotomized into dissatisfied and satisfied groups (cut off points of 1-3.5 = disatisfied , 4-5 =satisfied) . Cross tabulations were done using the dichotomized data by age, sex, education, and occupation and restoration experience. Calculations of overall quality was done using 4 satisfaction items in 5 point Likert scale by summing up the scores of then dividing by total number of items.

6.6.3 Data entry, cleaning and analysis

Data entry, cleaning and analysis was done using SPSS version 14 analysis program. Chi- square statistical test was done to check for statistical significance $p<0.05$.

6.7 Ethical issues

The research protocol was submitted to the MUHAS Higher Degrees Research and Publications Committee for reviews, approval and ethical clearance processing. Ethical clearance letter (Appendix 4) was obtained before commencing with the study. The aim of the study as well as potential risks and benefits were clearly explained to all participants and written informed consent in Swahili language was signed by each participant (Appendix 1b). A participant had the right and freedom to join or leave the study unconditionally and confidentiality was observed.

7 RESULTS

Distribution of participants

A total of 200 patients were enrolled in this study. The participants' age ranged from 18-67 years (mean 35 years), with majority (71.5%) being females. Sex distributions within all age group categories were similar with no statistically significant differences (p=0.436) (Table 1).

Table 1: Distribution of the participants by age and sex.

Age groups (yrs)	Sex		Total
	Male	female	
18 – 29	25 (28.7%)	62(71.3%)	87 (100%)
30 – 49	24 (25.8%)	69 (74.2%)	93 (100%)
50 – 69	8 (40%)	12 (60.0%)	20 (100%)
Total	57 (28.5%)	143 (71.5%)	200 (100%)

$X^2 = 1.66$ $p=0.436$

Distribution of restorations

In the current study 516 direct coronal tooth restorations were clinically and radiographically examined for quality. The restorations age ranged from 1 month to 5 years with 90% of them, 3 years old or less and (10%) 4 to 5 years old. Figure 1 shows distribution of restorations among the examined patients which ranged from 1-12 with a mean of 3. Majority (67%) of the individuals had 1 or 2 restorations each.
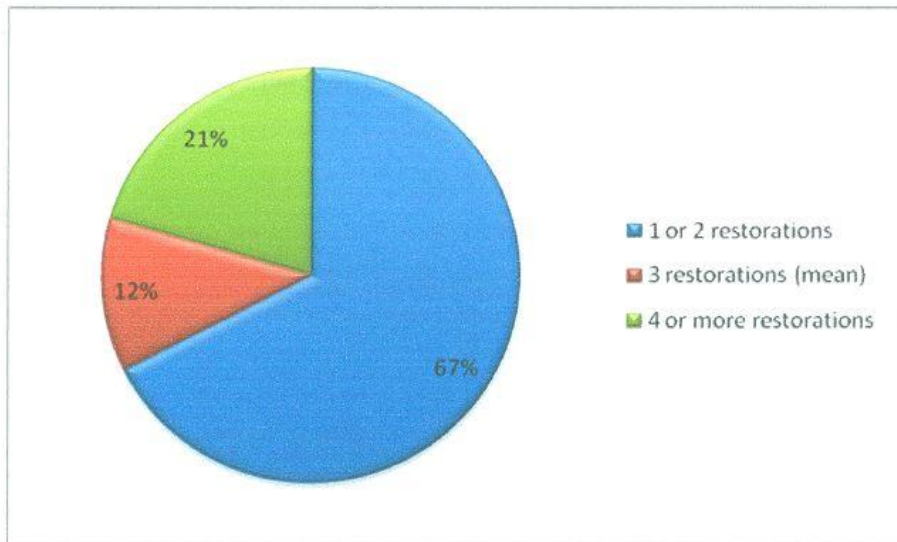
Figure 1: Distribution of restoration among the examined patients

Table 2 shows the distribution of the restorations according to restoration class and material used. The most commonly used restorative material was amalgam (48%)

Table 2: Distribution of the restorations by restoration class and material used, (n=516).

Restoration Class	Restorative material used			Total
	Amalgam	Composite	GIC	
I	90 (62.5%)	33 (22.9%)	21 (14.6%)	144 (100%)
II	155 (74.9%)	38 (18.4%)	14 (6.8%)	207 (100%)
III	0 (0%)	49 (87.5%)	7 (12.5%)	56 (100%)
IV	0 (0%)	55 (77.5%)	16 (22.5%)	71 (100%)
V	3 (7.9%)	5 (13.2%)	30 (78.9%)	38 (100%)
Total	248 (48.1%)	180 (34.9%)	88 (17.0%)	516 (100%)

Quality of restorations

Generally most of the examined restorations (63.0%) were acceptable (Figure 2). Individual quality characteristics acceptable restoration marginal integrity (82.8%) and anatomical form (76.2%) were higher than surface quality (70.9%) (Figure 3). Regarding surface texture 87% of the restorations had smooth surface texture and 4.5% slightly pitted needing repair. Acceptable anatomical contour accounted for 77.9% of the restorations while (81%) of the restorations showed no evidence of marginal ditching (Table 3). Colour mismatch (45.7%) accounted more on the unacceptable restorations followed by restoration overhangs (26.0%) and faulty contact point (22.7%). Secondary caries was found in 8.3% of the restorations (Table 3).
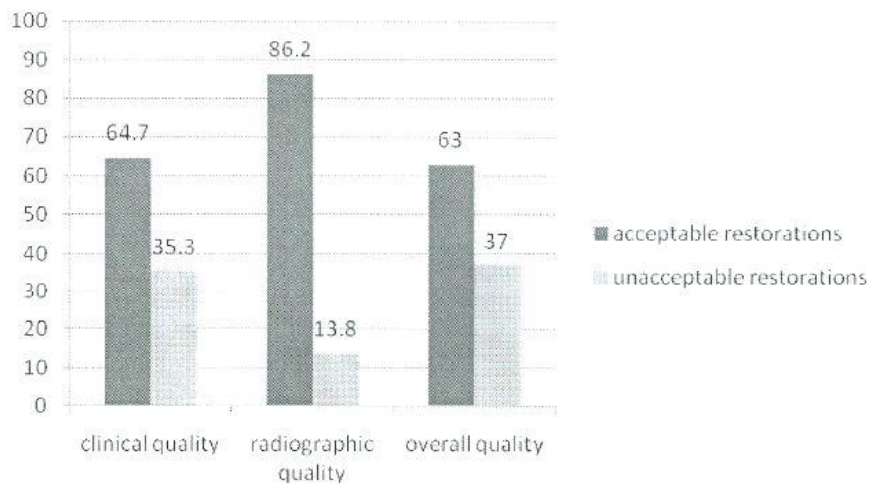
Figure 2: Percent distribution of restorations by clinical , radiographic and combined clinical radiographic assessment.
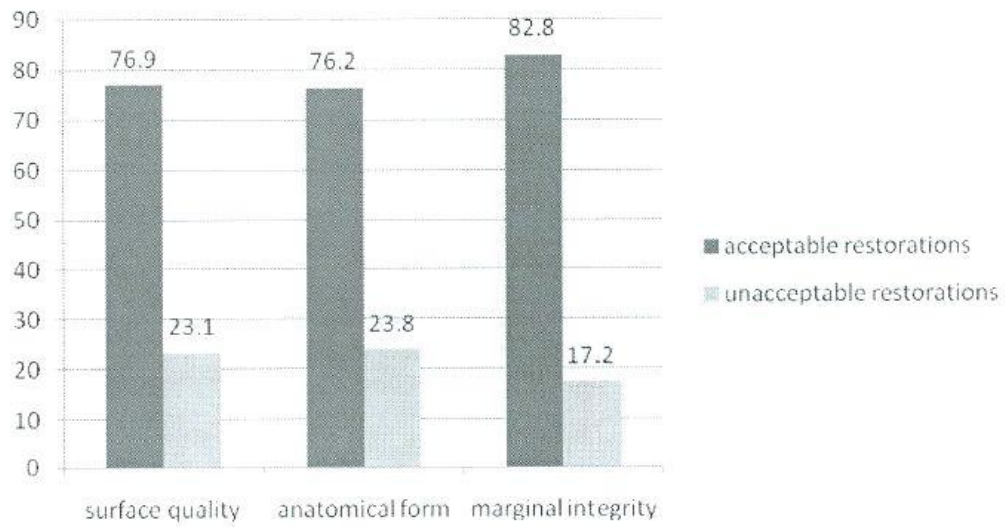
Figure 3: Bar chart of distribution of restorations by clinical assessment i.e (surface quality, anatomical form and marginal integrity).

Table 3: Distribution of restorations by quality according of modified Ryge 1980 criteria.

Clinical feature	Elements of clinical feature	Ranking	Frequency	
			n	%
Surface Quality	Surface Texture	1 smooth	451	87.4
		2 slightly rough, pitted correctable	23	4.5
		3 deeply pitted, can't be corrected	42	8.1
	Color match*	1 no mismatch	66	37.7
		2 minimal mismatch	29	16.6
		3 aesthetically unacceptable	80	45.7
	Irritation to soft tissue#	1 none	302	78.9
		2 mild	13	3.4
		3 severe	68	17.7
Anatomical form	Anatomical contour	1 restoration continuous with existing anatomical form	402	77.9
		2 restoration slightly under/over contoured correctable	30	5.8
		3 under/over contoured: dentin/base exposed/lost	84	16.3
	Contact Point **	1 functional contact point restored	226	71.3
		2 slightly open (may be self-correcting),	19	6.0
		3 faulty (self-correction is unlikely)	72	22.7
	Gingival margin contour#	1 no overhang	267	70.6
		2 small overhang – tears floss but can pass through	13	3.4
		3 large overhang – dental floss cannot pass	98	26.0
Marginal integrity	Marginal ditching	1 no visible evidence of ditching along the margin	422	81.8
		2 ditching not extending to dentin/enamel junction.	4	0.8
		3 dentin or base is exposed along the margin	90	17.4
	Marginal discoloration	1 no marginal discoloration	427	82.8
		2 discolorations not penetrating in a pulpal direction.	27	5.2
		3 discoloration has penetrated in a pulpal direction	62	12.0
	Fracture of restoration or both/ filling mobile	1 no fracture and restoration not mobile	461	89.3
		2 restoration mobile/fractured or caries contiguous with the margin of restoration, or tooth structure fractured	11	2.1
		3 restoration mobile or fractured, caries contiguous with restoration margin or tooth fractured	44	8.5
Secondary caries	Secondary caries	1 no secondary caries	473	91.7
		2 secondary caries present	43	8.3

Key:

Unacceptable restorations were ranked 3 except for secondary caries, which was ranked 2.

*   criteria apply to anterior restorations only
**   apply to approximal restorations with neighbouring tooth contact
#   apply to class II, III, IV and V only

Table 4 shows overall quality of restorations according by tooth type, restoration class and material used according to clinical –radiographic assessment. About half (53.2%) of the anterior restorations were of unacceptable quality. Class V had the largest proportion of unacceptable restorations (71.1%) and 52.3 % of GIC restorations were unacceptable. Proportion of unacceptable amalgam restorations (29.8%) was better than composites restorations (39.4%) with the difference being statistically significant (Table 4).

Table 4: Distribution of restorations by tooth type, restoration class and material according to overall quality. (n=516).

| Variable | Overall quality | | Total (N=516) | Statistical tests Chi –squire test |
	Acceptable (n=325)	Unacceptable (n=191)		
Tooth type				
Anterior	73 (46.8)	83 (53.2)	156 (100)	
Posterior	252 (70.0)	108 (30.0)	360 (100)	$x^2 = 24.2$; df $=1$; $p < 0.001$
Restoration class				
Class I	115 (79.9)	29 (20.1)	144 (100)	
Class II	129 (62.3)	78 (37.7)	207 (100)	$x^2 = 41.2$; df $=4$;
Class III	34 (60.7)	22 (39.3)	56 (100)	$p < 0.001$
Class IV	36 (50.7)	35 (49.3)	71 (100)	
Class V	11 (28.9)	27 (71.1)	38 (100)	
Material used				
Amalgam#	174 (70.2)	74 (29.8)	248 (100)	$x^2 = 25.9$; df $=1$
Composite*	109 (60.6)	71 (39.4)	180 (100)	$p < 0.001$
GIC	42 (47.7)	46 (52.3)	88 (100)	tested for # and *

key

\# Amalgam restorations
* composite restorations

Table 5 gives clinical quality of restorations according to the tooth type, restoration class and material used. Posterior restorations constituted about two thirds of all examined restorations. Proportion of unacceptable anterior and posterior restorations were 53.8% and 27.2% with the difference being statistically significant ($p=<0.001$). The percentage of unacceptable class V and IV were 71.1 and 50.7% respectively. Fifty two point three (52.3%) of the GIC restorations were unacceptable.

Table 5. Distribution of the restorations by tooth type, restoration class and material according to clinical quality (n=516).

| Variable | Clinical quality | | Total (N=516) | Statistical tests Chi –squire test |
	Acceptable (n=334)	Unacceptable (n=182)		
Tooth type				
Anterior	72 (46.2)	84 (53.8)	156 (100)	
Posteriors	262 (72.8)	98 (27.2)	360 (100)	$x^2=33.8$; df=1; $p<0.001$
Restoration class				
Class I	123 (85.4)	21 (14.6)	144 (100)	
Class II	131 (63.6)	76 (36.4)	207 (100)	
Class III	34 (60.7)	22 (39.3)	56 (100)	
Class IV	35 (49.3)	36 (50.7)	71 (100)	$x^2=41.2$; df=4; $p<0.001$
Class V	11 (28.9)	27 (71.1)	38 (100)	
Material used				
Amalgam#	180 (72.6)	68 (27.4)	248 (100)	$x^2=4.7$; df=1; $p<0.05$ (tested for # and *)
Composite*	112 (62.2)	68 (37.8)	180 (100)	
GIC	42 (47.7)	46 (52.3)	88 (100)	

key

Amalgam restorations
* composite restorations

Table 6 gives radiographic quality of restorations according to tooth type, cavity class and material used. The proportion of unacceptable anterior restorations and posterior restorations were 15.4% and was more than that of and posterior restorations 13.1% respectively, however the difference was not statistically significant. All glass ionomer restorations and class V restorations were acceptable radiographically. Composite restorations were more unacceptable than amalgam restorations with the difference being statistically significant.($p>0.05$)

Table 6: Distribution of restorations by to tooth type, class and material used according to radiographic assessment.

	Radiographic quality			
Variable	Acceptable (n=445)	Unacceptable (n=71)	Total (n= 516)	Statistical tests Chi –squire test
Tooth type				
Anterior	132 (84.6)	24 (15.4)	156 (100)	$x^2= 0.32$; df=1 p>0.05
Posteriors	313 (86.9)	47 (13.1)	360 (100)	
Restoration class				
Class I	119 (82.6)	25 (17.4)	144 (100)	$x^2= 15.4$; df =4;
Class II	183 (88.4)	24 (11.6)	207 (100)	$p<0.001$
Class III	50 (89.3)	6 (10.7)	56 (100)	
Class IV	54 (76.1)	17 (23.9)	71 (100)	
Class V	38 (100)	0 (0)	38 (100)	
Material used				
Amalgam#	215 (86.7)	33 (13.3)	248 (100)	$x^2= 4.045$; df =1;
Composite*	142 (78.9)	38 (21.1)	180 (100)	p<0.05
GIC	88 (100)	0 (0)	88 (100)	(tested for # and *)

key

Amalgam restorations
* composite restorations

Figure 4 shows a bar chart of distribution of restorations according to radiographic examination. Secondary caries and apical periodontitis were present in 10.5% and 7% of the restorations, respectively.
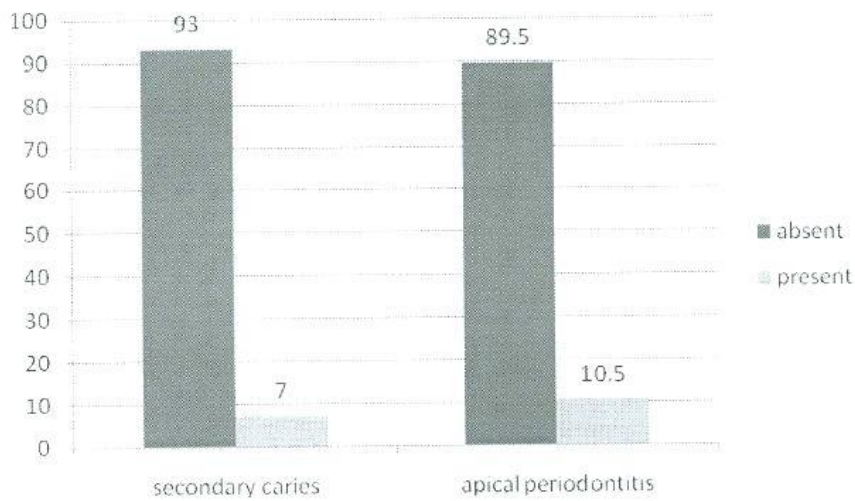
Figure 4: Bar chart of distribution of restorations by radiographic quality attributes (secondary caries and apical periodontitis) assessment.

Patient satisfaction with restorations

Table 7 shows percent distribution of patients according to items used to assess satisfaction and levels of satisfaction. The most reason for dissatisfaction was colour mismatch whereby (38.1%) of participants were dissatisfied and 2.4% neither dissatisfied nor satisfied. The second most frequent reason for dissatisfaction was poor appearance (35.7%).

Table 7: Percent distribution of patients by items used to assess satisfaction according to satisfaction levels.

| Satisfaction item | Level of satisfaction | | |
	Disatisfied	Neither/ nor disatisfied	Satisfied
Satisfaction with colour match	38.1%	2.4%	59.5%
Satisfaction with appearance	35.7%	2.4%	61.9%
Satisfaction with chewing	29.8%	5.6%	64.6%
Satisfaction with cost of filling	18.5%	13.5%	68.0%

The study revealed a general satisfaction of 66% with the restorations whereas the difference in satisfaction between sex were not statically significant. By age, older patients (above 50-69 years) were more satisfied than younger patients, but the difference in satisfaction was not statically significant. Satisfaction with the restorations according to occupation revealed no statistically significant difference (Table 7).

Table 7: Patient satisfaction with restorations by socio-demographic characteristics and restoration experience.

	Satisfied (N=132)	Dissatisfied (N=68)	Total (N=200)	Statistical analysis Chi –squire test
Social demographic Characteristics				
Sex				
Male	35(61.4%)	17 (38.6%)	52	χ^2=0.7; df=1;
Female	97(67.8%)	46 (32.4%)	143	P=0.386
Age groups (years)				
19-29	56 (64.4%)	31 (35.6%)	87	χ^2= 1.2; df=1; p>0.05
30-49#	60 (64.5%)	33 (35.5%)	93	(tested for # and *)
50-69 *	16 (80.0%)	4 (20.0%)	20	
Educational level (formal)				
None or primary	14(73.7%)	5 (26.3%)	19	
Secondary	32(53.3%)	28 (46.7%)	60	
College/University	86(71.1%)	35 (28.9%)	121	χ^2=6.2, df=2; P=0.046
Occupation categories				
Peasant, others	2 (66.7%)	1 (33.3%)	3	
Student	45(71.4%)	18 (28.6%)	63	
Civil servant	70(61.4%)	44 (38.6%)	114	
Businessman/woman	15(66.7%)	5 (33.3%)	20	χ^2=3.4, df=4 P=0.499
Restoration experience (frequency)				
Once	37(56.1%)	29 (43.9%)	66	χ^2=5.7; df=1; P=0.038
Twice	53(76.8%)	16 (23.2%)	69	(tested for once and
Three or more times	42(64.6%)	23 (35.4%)	65	twice)

Key # age group 30-49   *age group 50-69

8   DISCUSSION

The purpose of this study was to assess quality of direct coronal tooth restorations and satisfaction with the restorations among patients attending public dental clinics in Dar as Salaam city.

Assessment of quality of restorations was done based on Modified Ryge criteria a method which is widely used for quality assessment. Patient satisfaction assessment utilized satisfaction questionnaire delivered in form of interview. To ensure reliability intra-examiner calibration was performed by examining twice every twentieth participant. Improper hospital record keeping at collection sites necessitated relying on patients recall ability on where and when a restoration was done hence the results may be subject to recall bias.

The participants included a diverse population relative to age, sex, and education. Sex distribution shows female dominancy, the difference which can be attributed to the observation that females are affected by dental caries much more than males, and also more sensitive to health issues, thereby forcing them to seek treatment more frequently (Kutesa et al., 2005).

The average number of three restorations per individual as observed in this hospital-based study is high for an average Tanzanian as the reported F-component of DMFT is negligible (COHU, 2002). The reasons for the high mean number of restorations can be partially explained by a segment of population may be using restorative care more than others.

Types of restorations were distinguished according to Black's classification with domination of posterior restorations (class II followed by Class I restorations). This restoration pattern can be partially explained by similar pattern of dental caries in Tanzania whereby posterior teeth especially molars are affected more than other type of teeth (Rugarabamu et al., 2002). The morphology of molars probably makes them more retentive to plaque, not easily accessible to cleansing and hence more prone to caries attack. Udoye and Ukechi (2009) in Nigeria had similar findings whereby the pattern shows more of class II followed by class I restorations.

Amalgam was the most frequently used material taking almost half of all the examined restorations followed by composites. Similar trend was observed by Udoye and Ukechi, but the proportion of amalgam was higher than in the present study. Comparison of the restoration

pattern data to national data is limited as there are no retrievable publications on quality of restorations in Tanzania.

Proportion of unacceptable restorations in this study was similar to those reported by Mjor (1981), Goldberg et al. (1980), Richardson and Boyd (1973), Skogedal and Heloe (1979), and Allan (1969). The failure percentages found in these studies ranged from 33% to 40%. Some investigators reported higher percentages of unacceptable restorations than in the current study. Brukiene et al., (2004) and Moore & Stewart (1967). In contrast, studies by Krooze et al., (1990) and Rytomaa et al., (1984) showed lower proportions of unacceptable restorationsy. The great differences between failure percentages of the present study and those showing higher values of unacceptable restorations may be due to low cariogenic challenge in our population.

Contribution of individual clinical feature used to assess quality of restorations shows anatomical form (23.8%) and surface quality (23.1%) were worse than marginal integrity (17.2%). These results are far better than those of similar study done by Brukiene et al., (2005) who on the contrary found 47.58% of restorations needing replacement due to unacceptable anatomical form. The same study also shows the surface quality contributed less to overall unacceptable restorations which is the opposite in this study.

A restoration is considered to have an *overhang* when there is a ledge of filling material extending beyond the anatomical shape of a tooth. Restoration overhangs were found in 26.0% of the examined restorations. Most studies have reported higher proportions of restorations with margin overhangs ranging from 34% to 71% than were found in the present investigation (Coxhead et al.1978, Hakkarainen and Ainamo 1980, Bjorn et al., 1969, HakKaranein and Ainamo,1980; Sikri and Sikri,1993. This difference can be attributed by a reason that most of the restorations were done at the Muhimbili national hospital dental clinic, which is a dental training hospital with constant supervision.

Dental aesthetics has increasingly become an important and rewarding discipline in dentistry as patients have begun to request anterior restorations of high aesthetic quality. Clinicians must be prepared to meet the aesthetic demands and high expectations of their patients. This is of paramount importance as it affects patient's satisfaction and service utilization.

In the present study aesthetically unacceptable restorations due to colour mismatch had the highest contribution to overall unacceptable restorations. This may be due lack of adequate material to allow proper shade selection or deficiencies on shade selection or matching skills of operators. In contrast to this finding Udoye and Okochu 2009 in Nigeria found colour mismatch not a most common contributing factor to restorations needing replacement.

Among the three elements of marginal integrity used in this study marginal ditching contributed more on the unacceptable marginal integrity. The finding is supported by other studies showing similar pattern (Udoye and Okochu 2009).

Secondary caries usually occur at the interface of tooth and restoration and clinical studies shows more than 50% of replacement of restorations is due to secondary caries. Secondary caries was relatively lower in this study (8.3% clinically and 10.5% radiographically). As compared to other studies (Krooze et al., 1990, Udoye and Okochu, 2009). Better results on marginal integrity in this study explains for lower proportion of secondary caries as poor marginal integrity increases risk for development of secondary caries (Krooze et al.,1990).

Patient satisfaction was measured by interviewing patients with direct coronal tooth restorations using patient's satisfaction questionnaire. Interviewing ensured validity as the patient had to respond on satisfaction with a particular restoration and not with general restorative care. Patient's satisfaction was generally high and the most dissatisfying reason was colour mismatch. Colour mismatch can be explained by lack of enough restorative materials in our clinics rendering shade selection difficult. Adults and elderly (87.2%) were more satisfied than younger ones. Comparison of national and international data on patient satisfaction with restorations was limited, as there is only retrievable similar study published worldwide and none in Tanzania. Thakib al Salaan 2006 in Riyadh had similar findings whereby, satisfaction was high and the most dissatisfying reason was non-acceptance of the colour and/or shape of the tooth. Proportion of participants complaining of postoperative sensitivity did not differ from Shalans findings (Shalan, 2006). Generally quality of restorations especially with anterior restorations needs improvements as indicated by objective (clinical and radiological assessment performed) and subjective assessment (patients

satisfaction). Correlation between patient satisfaction with colour match and colour matching observed clinically was significant.

9   CONCLUSIONS

Generally prevalence of acceptable restorations was high and different by tooth position, restorative material and restoration class, with posterior restorations being more acceptable than posterior restorations. Class IV and V and Glass ionomer were the most unacceptable restoration classes and material used respectively. Quality of restorations was not different between males and females. Patient satisfaction with restorations was generally high but was not statically different by age and sex. Colour mismatch was the most common problem both by clinical examination and patient's opinion during interview.

10   RECOMMENDATIONS

Ministry of health through Central Oral Health Unit (COHU) and School of Dentistry (SoD) should ensure availability of anterior restorative materials to allow appropriate shade selection during training and service provision. In view of the incoming curriculum review at MUHAS emphasis should be stressed on anterior restorations especially on shade selection as the most common reason for unacceptable restoration was colour mismatch. Proper use of matrix system for approximal restorations should be emphasised to avoid restoration overhangs and attain proper contact. Evaluation of restorations for quality and patient satisfaction should be done regularly to identify areas needing improvement.

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