NON-SURGICAL ROOT CANAL TREATMENT AT MUHIMBILI NATIONAL HOSPITAL - PATIENT AWARENESS, REASONS FOR PROVISION AND OUTCOMES

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July, 2010

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By

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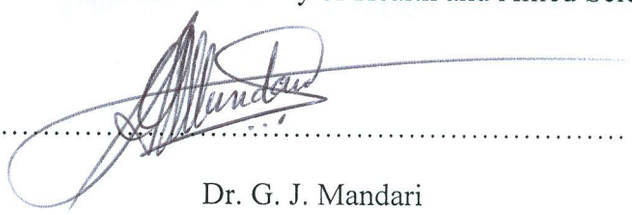
A dissertation submitted in partial fulfillment of the requirements for the degree of Master of Dentistry (Restorative Dentistry) of Muhimbili University of Health and Allied Sciences

Muhimbili University of Health and Allied Sciences

July, 2010

CERTIFICATION

The undersigned certify that they have read this dissertation entitled *"Non-Surgical Root Canal Treatment at Muhimbili National Hospital - Patient Awareness, Reasons for Provision and Outcomes"*, and hereby recommend for acceptance by the Muhimbili University of Health and Allied Sciences as partial fulfillment of the requirements for the degree of Master of Dentistry (Restorative Dentistry) of Muhimbili University of Health and Allied Sciences



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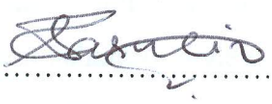
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DECLARATION AND COPYRIGHT

I, Dr. Augustine Mbehoma Rukoma, declare that this dissertation titled "Non-surgical Root Canal Treatment at Muhimbili National Hospital - Patient Awareness, Reasons for Provision and Outcomes" is my own original work and that it has not been presented and will not be presented to any other University for similar or any other degree award.

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DEDICATION

This dissertation is dedicated to my beloved wife,

Mary Goreth

and my children

Victoria and Sylvia

ABSTRACT

Background: For a long time, the oral health care in Tanzania has been dominated by tooth extractions which constitute about 90% of dental treatment rendered countywide. Summaries of dental clinic data from 1995 to 2000 indicated an overall restoration/extraction ratio of 1:98. Non-Surgical Root Canal Treatment (NS-RCT) is an alternative dental treatment to tooth extraction that enables the diseased tooth to be maintained as functional, however if it fails surgical root canal treatment yet is another alternative.

Objective: To assess patient awareness, reasons for provision and outcome of non-surgical root canal treatment among patients attending in dental clinics at Muhimbili National Hospital Tanzania.

Materials and Methodology: This cross-sectional study assessed patient awareness, Reasons for provision and outcome of NS-RCT among patients at MNH dental clinics, Tanzania between June and July 2008. A total of 387 patients with age ranging from 15-83 years were conveniently selected to participate in the study. Structured questionnaires were used to gather information on social demographic characteristics, patient awareness, and satisfaction with the provision of NS-RCT. Information on diagnosis, presenting problem and treatment to be provided and reasons for providing NS-RCT were obtained from clinical examination records. The obturation quality of the 120 treated teeth were radiographicaly assessed. Data was analyzed using EPi Info 6 version 6.04 and statistical level of significance was reported at 0.05.

Results: There were more females (56.6%) than males (43.4%). Age range was 15-83 years with median age of 34 years. Of the 387 patients studied only 25.6% were aware of NS-RCT. Significantly more educated respondents were aware of RCT compared to less educated respondents ($\chi 2=12.79$, $p<0.001$). Patients in need of NS-RCT consisted of one third (n=128; 33.1%) of all oral treatment needs. Of all patients in need of NS-RCT, the majority were females in all age groups. Dental caries was the most frequent reason of NS-RCT (78.3%) followed by traumatic pulp necrosis (16.7%). Slightly more than one third of all teeth treated were the anteriors 40% (maxillary: n=44; 36.7% and mandibular: n=4; 3.3%). Molars were second 30.8% (maxillary: n=17; 14.2% and mandibular: n=20; 16.7%). More maxillary teeth (75.0%) than mandibular ones (25%) were treated, the difference being highly significant

(*p=0.001*). Of the 120 teeth treated with NS-RCT, radiographic assessment revealed that overall 65% of teeth were obturated adequately i.e. adequate apical and lateral seal. In regard to apical and lateral seal adequacy of obturation was 68.3% and 75% respectively. Overall, the premolars were most adequately obturated (82.9%) followed by anterior teeth (70.8%) and lastly molars (40.5%). Overall satisfaction with NS-RCT was 96.6%, (mastication = 97.5%; appearance [form and color] = 90.8%) more so for males than females.

Conclusions: From this study it is concluded that, more than two thirds of patients were not aware of NS-RCT; caries pulp exposure was the main pathology that led to NS-RCT and overall, 65% of the root canal treated teeth had their canals adequately sealed both apically and laterally.

Recommendations:

1. Community education is required to raise the awareness about NS-RCT.
2. Improvement of dentists' skill in treatment of molar teeth and acquisition of modern endodontic equipment and instruments.
3. More and long term studies evaluating the provision and treatment out-come of NS-RCT in the country are need.

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LIST OF ABBREVIATIONS

AP..... Apical Periodontitis

CDC..... Centers for Disease Control and Prevention

COHU ..... Central Oral Health Unit

DB..... Distobuccal

DDS ..... Doctor of Dental Surgery

GP..... Gutta Percha

IMF..... International Monetary Fund

IPPM ..... Intramural Private Practice - Muhimbili

L ..... Lingual

MB..... Mesiobuccal

M.Dent ..... Master of Dentistry

MNH ..... Muhimbili National Hospital

MUHAS..... Muhimbili University of Health and Allied Sciences

NS-RCT .... Non-Surgical Root Canal Therapy

P ..... Palatal

RCT ..... Root Canal Treatment/Therapy

SPHSS..... School of Public Health and Social Sciences

S-RCT ..... Surgical Root Canal Treatment/Therapy

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1. INTRODUCTION AND LITERATURE REVIEW

Background information

Root Canal Therapy (RCT) is a procedure which involves removal of pulp contents of a tooth (i.e in the pulp chamber and root canal) and its replacement with biocompatible artificial material that hermetically seals the canal(s) (Figure 1).

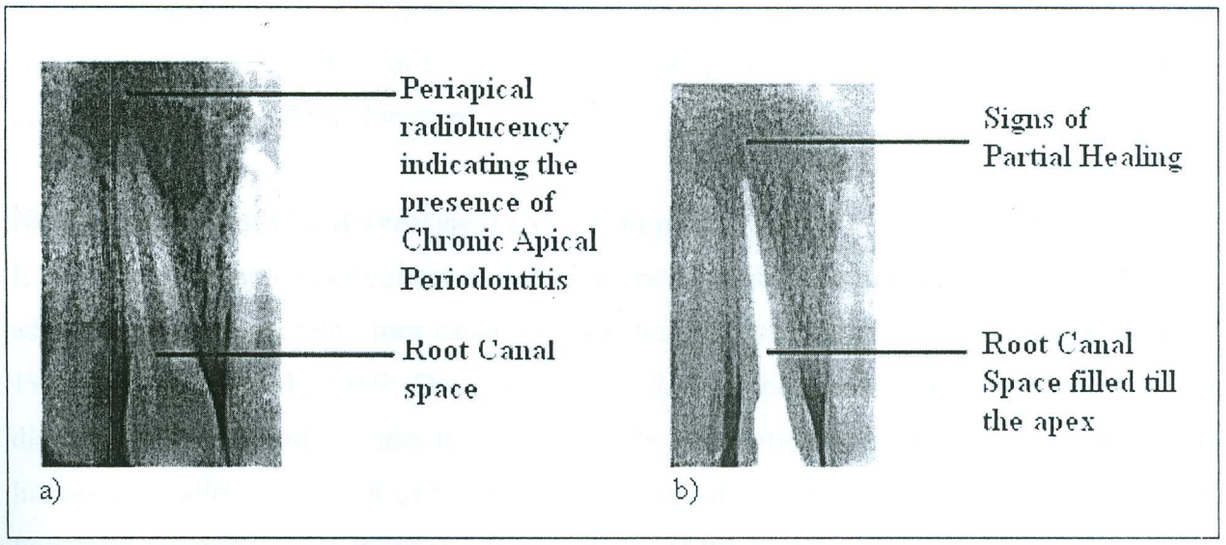


Figure 1: Root canal space (a) before Root canal treatment (b) after Root canal treatment

There are two major root canal treatment (RCT) techniques, non-surgical root canal treatment (conventional or orthograde) and surgical root canal treatment (S-RCT). Non-surgical root canal treatment (NS-RCT) is the removal of the dental pulp and its replacement with biocompatible artificial material that hermetically seals it. S-RCT, in addition to the above involves raising the flap and a retrograde fill. Formerly the two were collectively denoted as RCT until the American Association of Endodontists re-designated them as NS-RCT and S-RCT (Dovgan, 2004a). NS-RCT is usually carried out in teeth with severe inflammation of the pulp (irreversible pulpitis), irreparable pulp exposure and dead pulp (pulp necrosis) with or without apical periodontitis (Tronstad, 1991); or intentionally when a tooth with questionable pulp vitality is to be used for abutment in crown or bridge work in prosthetic treatment (Grossman,

1978). The goal of NS-RCT is prevention and/or elimination of pathology of endodontic origin in the root canal and periapical areas.

Surgical Root Canal Treatment (S-RCT) includes any surgical procedure used to remove inflammation and/or infection from roots and surrounding areas of the affected tooth or to repair an existing problem. It has also been recommended mainly when non-surgical root canal treatment has failed (Cohn, 2006). S-RCT involves not only the removal of the contents of the root canals and a retrograde surgical procedure but, also repair of perforations, root resection and root resorption. N-SRCT or S-RCT of the offending tooth will enable it to be retained in the oral cavity and maintain its function.

Non-Surgical Root Canal Treatment (NS-RCT) procedure

It is generally accepted that correct diagnosis, proper debridement, preparation and subsequently adequate obturation of the root canal are essentials for successful NS-RCT (Bystrom et al., 1985; De Moor et al., 1999; Dovgan, 2004b). Radiography is the most reliable of all the diagnostic methods and provides the most valuable information. In all endodontic cases, a good intra-oral parallel radiograph of the root and periapical region is mandatory (Carrotte, 2009). Periapical radiographs are taken at different stages of the treatment process. It is recommended that a pre-operative radiograph be used to confirm diagnosis, assess the morphology of the canal(s), assess the status of the periapical area and facilitate estimation of the lengths of the tooth and the root canal(s). A second radiograph is taken with file(s) in the canal(s). This will confirm the correct apical location of the tip of the file so as to ensure that instrumentation is done within the canal(s). By so doing under instrumentation or extension of the instrument into the periapical area is avoided. A post-operative periapical radiograph is taken to assess, among others, the quality of the canal obturation (in terms of the *lateral* and *apical* seals) and the quality of the coronal restorations (Kustarci et al., 2007).

The treatment involves preparation of an access cavity and removal of the contents of pulp chamber and root canals (i.e. the pulp tissues), followed by cleaning and shaping of the canals to receive the obturation/filling material resulting in complete obturation of the root canal(s).

Regardless of the instrumentation technique or system used, preparation of the canal(s) involves both mechanical and chemical components; hence the term "chemo-mechanical" preparation. Currently the most widely used irrigation solution is sodium hypochlorite, which has antibacterial, lubrication and tissue dissolving properties when used within the concentration of 0.5-5.25% (Harty, 2004). Following the chemo-mechanical preparation of the canal(s), different materials may be used for obturating the canals. However, gutta-percha has been reported to be the most commonly used, and cold lateral condensation is the obturation technique of choice (Peak et al., 2001). It is crucial that the guttapercha point should not be bent during insertion into the root canal, and that the size of the guttapercha point used should be in accordance with the size-coding marked on their container (Iványi et al., 2002). NS-RCT can be done in single or multiple visits depending on the nature of the disease, availability of instruments and materials, availability of time, skill and experience of the operator, and accessibility of the treated tooth for instrumentation. Further more, teeth with vital pulp(s) are generally advocated to be filled in the same session, whereas infected root canals traditionally need a minimum of one week intra-canal medication. However, promising results have been obtained in single-visit approach.

Success of NS-RCT

Success rates of treatment modalities are an important part of evidence-based practice; they are the basis of treatment planning and prognostic considerations (Peak et al., 2001). Success of NS-RCT is said to have been achieved when the tooth is functional, the patient is free of symptoms (pain, swelling and sinus) and the peri-radicular area(s) remain or return to normal (De Moor et al., 1999; Harty, 2004; Torabinejad and Walton, 2009).

A successful outcome relies on adequate removal of micro-organisms from the canal system and prevention of recolonisation or propagation of residual micro-organisms through the placement of a root filling that obturates the space entirely, combined with a restoration that produces a satisfactory coronal seal (Briggs and Scott, 1997; Peak et al., 2001). Despite being one of the most technically demanding procedures in restorative dentistry conventional root canal treatment (NS-RCT) completed in dental schools or by specialists has been shown to be highly successful (Molven and Halse 1988; and Smith et al., 1993).

Success of NS-RCT is said to be dependent on the severity of the underlying pulp and/or peri-radicular pathology and it ranges from 70-98%. Success in a tooth without periapical lesion is 98%, while that with periapical lesion is 80-85% (Smith et al., 2007; Doyle et al., 2006; Deutsch 2001; Peak et al., 2001; Sequeira, 2001; Ahmed et al., 2000). In their study Ng et al., (2007) reported success rates of treatments completed at least 1 year prior to review, ranging between 68% and 85% when strict criteria were used. They also reported a success rate of secondary root canal treatment to be 77%. Maxillary anterior teeth have been reported to have better success rates than other types of teeth (Peak et al., 2001). Further more even in single visit success was similar to multiple visits (Field et al. 2004). In studies to determine the clinical and radiographic success rate of single-visit root canal treatment (Field et al., 2004) found the success rate to be 89.2%. Pekruhn (1986) reported a success rate of 94.8%; Oliet (1983) 89.5% and Soltanoff (1978) 85%.

The success rates can be improved by ensuring that practitioners have adequate knowledge of the internal dental/root morphology that allows for accurate location of the canals together with performing proper debridement and cleaning. These together with adequate obturation of the canals and filling of the access cavity enhance the success of NS-RCT. The use of magnification, adequate lighting and modified access may assist in accurate location of the root canals (Amauri et al., 2006). Other factors affecting the success of RCT include systemic disease, inaccessibility to endodontic instruments, canal curvature, preoperative peri-radicular lesion, widening of periodontal ligament space, preoperative pulp vitality, and years of operator experience and obturation quality (Negishi et al., 2009; Smith et al., 2007). Ng et al., (2008) emphasise the presence of pre-operative periapical lesion, apical extent of root filling and quality of coronal restoration proved as significant prognostic factors in of secondary root canal treatment. In most cases NS-RCT is successful, but when it is questionable or has failed S-RCT may be necessary to salvage the tooth (Cohn 2006). However, Kvist and Reit (1999) observed that, after 24 months, there were no differences were observed regardless of whether a conservative approach or surgical treatment measures had been used. Therefore recommend surgical treatment of relapse should only be considered if orthograde treatment of the root canal

is no longer possible; conservative revision is then recommended prior to the surgical revision within a short period of time, if possible.

Patient awareness about NS-RCT

People across the world are becoming more aware about dental health and how to maintain it (Tandon, 2004). Also awareness about RCT and its importance has reportedly increased as population expands and ages (Glickman and Koch, 2000). In developed countries like U.S there is an increase in awareness on RCT, leading to decrease in demand for extraction from 13% to 3.7%, while root canal treatments have risen from 1.7% to 3.3% (Tandon, 2004). In developing countries like Pakistan awareness about retaining one's natural dentition had been shown to rise steadily (Ahmed et al., 2008).

In Tanzania, the use of oral health care services are limited and strongly related to pain experience (van Palestein and Nathoo, 1990). Other principal factors associated with the utilization of oral health care services in Tanzania reported were distance to treatment facility and previous dental symptoms (Mosha and Scheutz, 1993). Lack of awareness on available treatments is considered to be the major reason for poor utilization of oral health facilities and patient's delay to seek dental treatment (Mosha and Scheutz, 1993).

Without knowledge and understanding of available dental services there may be no informed decision or action to promote oral health. Education levels of an individual may play an important role on oral health and in turn utilization of dental NS-RCT inclusive. Paulander et al., (2003) reported education level to influence the oral conditions and so should be considered in assessing risk, and in planning appropriate preventive measures. In Tanzania, patient awareness and knowledge on NS-RCT has not been reported.

Oral treatment needs

Determination of treatment needs is an important component in delivery of health services as they help in planning preventive and curative interventions, manpower development and deployment, as well as identification and allocation of equipment, instrument and other materials. Parkash et al. (2006) in assessing dental workforce issues as a global concern reported

a definite transition in disease patterns that are contributory to a change in the treatment needs of patients. They also reported that an increased demand exists for conservative treatments, including endodontics, dental implants, and cosmetic surgery, while dental extractions are decreasing. They suggested a workforce to be well equipped and able to cope with the changing needs of society in improving the performance of the oral health system. In Tanzania literature is lacking information about objective treatment need in regard to teeth conservation.

Patients in need of NS-RCT

As the population expands and ages, the demand and need for endodontic therapy can be expected to increase (Glickman and Koch, 2000). In developed countries for example, in the U.S, the number of patients aged 65 years and older who are in need of RCT is increasing (Goodis, 2001). In a study done in a Nigerian Teaching Hospital by Ajayi and Ajayi (2007) to determine the proportion of persons in need of endodontic treatment, it was found that females had more need (56.4%) compared to males (43.6%).

Reasons for NS-RCT

The reasons for root canal treatment have remained unchanged for many decades and these include: dental caries, trauma, management of malaligned teeth, intentional pulp removal for crown and bridge work, root resorption, failed restoration, tooth wear, periodontal disease and any combination of these (Grossman, 1978; Bjørndal, 2006; and Oderinu et al., 2006). Usually the most commonly reported reasons for RCT are infection due to dental caries and traumatic injury of teeth (Bjørndal, 2006). Another study done at the Nigerian Teaching Hospital reported that, dental caries was the most common reason for endodontic treatment while traumatic exposure of the pulp was the second common reason (Oderinu et al., 2006). Self-reported reasons for dental visits in which a root canal treatment was prescribed were toothache, abscess, and tooth sensitivity (Boykin et al., 2003). In Tanzania, although NS-RCT is being provided, reasons for provision of root canal treatment have not been documented.

Type of teeth treated with NS-RCT

Tooth type treated by NS-RCT has been reported either by jaw, tooth type or a combination of both. In a study by Gulsahi et al., (2008), significantly more root-filled teeth in the maxilla (62.3%) than in the mandible (37.7%) were reported. Also, Peak et al., (2001) found more treated maxillary teeth (n=241; 59%) than mandibular teeth (n=165; 41%). The right maxillary second pre-molars were the most commonly root-canal filled teeth followed by the right mandibular first molars, and the right maxillary first pre-molars (Gulsahi et al., 2008). Other studies on types of teeth commonly treated with NS-RCT have molars ranking higher than other tooth types (Bjørndal, 2006; Kirkevang et al., 2001) and, more frequently, the first mandibular molar (Zaatar et al., 1997). On the contrary Boykin et al., (2003) reported the incidence of endodontic treatment by the tooth types as being evenly distributed among the anterior teeth, premolars, and molars.

Most studies on endodontic treatment describing the socio-demographic details of patients and the types of teeth treated have been conducted in developed countries (Eckerbom et al., 1989). However, a study done in Nigeria by Oderinu et al., (2006) showed that premolars were the most commonly treated teeth, followed by anteriors (incisors and canines) while molars were treated most rarely. In Tanzania, no data are available in regard to types of teeth treated by NS-RCT.

Quality of Root Canal Fillings

The quality of obturation can be assessed radiographicaly by examining the compaction of the GP in the canal towards the walls (lateral seal), and towards the apical constriction (apical seal) as reported by De Moor et al., (1999). Obturation is said to be adequate if the root filling is within 2mm from radiological apex (Peak at al., 2001) or if length, density and taper is acceptable (no voids) (Rafeek et al., 2009).

Sjögren et al., (1990) showed that canals filled to within 2 mm. of the radiographic apex were associated with the higher success rates while inferior technical quality of root fillings (inadequate) is considered to be the main cause of clinical failure Eckerbom et al., (1989).

Incomplete obturation of the root canal leaves residual space for microbial colonisation and proliferation.

Grieve and McAndrew (1993) reported that the majority of root fillings in their study of teeth with post retained crowns were unsatisfactory. Saunders et al. (1997) found that 39% of root fillings were greater than 2 mm from the radiographic apex and stressed the need to improve quality of root canal treatment in general dental practice. In the UK Air force base, Peak et al. (2001) reported adequacy of obturation to be 50%; and Bołtacz-Rzepkowska and Pawlicka (2003) in the Łódź region of Poland 49%. In developing countries, some studies assessing radiographic technical quality of root canal treatment have also been performed. In Jordan, Barrieshi-Nusair (2004) reported 61% of obturated teeth as being adequate with fillings of acceptable length (apical seal adequate). In Trinidad and Tobago, Rafeek et al. (2009) found 72.2% of root filled canals had adequate length, density and taper. To-date, there is no reported data on quality of obturation of NS-RCT performed in Tanzania.

Patient satisfaction with NS-RCT

Patient satisfaction is a personal evaluation or appraisal of a service or product received (Aharony and Strasser, 1993; Pascoe, 1983). Data on patient satisfaction has an influence on health-related behavior (Pascoe, 1983). In developed countries, patient satisfaction is a key factor in quality assessment of the health care system (Gold and Woodridge, 1995), whereas in developing countries, the main quality concern has been the accessibility to health care services (Mera, 2002). Measures of oral health perception constitute an important component to information about health status, as they are personal judgments and evaluation of one's own health status, integrating different components, such as diseases, functioning, and feelings (Stewart, 1998).

In the USA, satisfaction with endodontic treatment was 97% (Salehrabi and Rotstein, 2004) while in a study done in Turkey (Faculty of Dentistry, Hacettepe University), 82% of patients were satisfied with their treatment, regardless of their level of education, age and sex (Gõrduysus and Gõrduysus, 2000). -

Satisfaction can be assessed subjectively and there are reports of an improved quality of life following NS-RCT (Salehrabi and Rotstein, 2004). With the introduced reforms in the provision of health services in Tanzania, there is a need for assessing of patient satisfaction and it should be undertaken so as to enable continuous quality improvement.

2. STATEMENT OF PROBLEM

For a long time, the oral health care in Tanzania has been dominated by tooth extractions which constitute about 90% of dental treatment rendered countywide. Clinical and epidemiologic caries data have shown very low restoration/extraction ratios with a tendency for further decrease (Muya et al., 1984; Mosha et al., 1994; COHU, 2002). Summaries of dental clinic data from 1995 to 2000 indicated an overall restoration/extraction ratio of 1:98 (COHU, 2002). A recent epidemiological study indicated negligible rates of restorative care among adults (Sarita et al., 2004).

It is expected that with time, the treatment profile would change towards rendering more restorative care. The persistence of oral healthcare that is dominated by tooth extractions gives bad impression to the dental profession in Tanzania. Loss of teeth can seriously compromise the functions of the dentition and affect one's health. Loss of posterior teeth can impair mastication while loss of anterior teeth can compromise esthetics and speech.

It ought to be remembered that replacement of natural teeth with artificial ones can not restore exactly the functions of lost teeth. In Tanzania, treatment which can preserve the teeth like Non-surgical root canal treatment (NS-RCT) has been going on for a very long period now, but yet still frequency of extraction is high.

The Ministry of Health is determined to increase the level of restorative care in Tanzania (COHU, 2002). However, efforts aimed at achieving this goal need to be supported by a thorough understanding of the prevailing barriers to providing and receiving restorative care. Kikwilu et al., (2009) reported five main barriers to restorative included: No advice received from dentist, Lack of knowledge on restorative care, Lack of habits for going for dental check-ups, Bother that one may get in seeking restorative care and Past experience with dental treatment. However, currently there is no statistics at all, about provision and outcome concerning NS-RCT at MNH therefore, the need for this investigation.

3. RATIONALE OF THE STUDY

There is a high rate of tooth extraction countrywide (Frencken et al., 1990; Mosha and Lema, 1991; Simon and Matee, 1999; Kikwilu et al., 2001). For example, in the year 1993, of the 318,911 patients who attended dental treatment in government dental clinics, there were 259,894 teeth extracted whereas only 17,993 teeth conserved (Simon and Matee, 2001).

Non-surgical root canal treatment (NS-RCT) is among the various dental treatment procedures carried out by the dental professional in the country. However, its provision and outcome have not been evaluated. It is the aim of this study to assess the awareness, need, provision and outcomes of NS-RCT among patients attending MNH.

Knowing the proportion of patients who are aware of NS-RCT will indicate if there is a need for raising awareness about NS-RCT to patients attending dental clinics or general population whereas knowing the need for NS-RCT would give vent to resources required (human, instruments, equipments and materials). Further more knowing the reasons for provision of NS-RCT will indicate if there is a need of strengthening preventive measures while assessing the outcome would give a picture on the prognosis of the treatment and suggest areas in need of improvement.

It is hoped that results accruing from this study will provide baseline data which will assist planners in oral health care maintaining or improving the provision of NS-RCT at MNH and countrywide through both the training and service sectors of oral health delivery mechanism.

4. OBJECTIVES

Broad objective

To assess awareness, reasons for provision and outcome of "non-surgical" root canal treatment among patients attending Muhimbili National Hospital

Specific objectives

1. To determine patient awareness about NS-RCT
2. To determine the oral treatment needs
3. To determine the needs for NS-RCT
4. To determine the reasons for providing NS-RCT
5. To determine the types of teeth treated with NS-RCT
6. To assess the obturation quality of NS-RCT
7. To determine patients satisfaction with NS-RCT.

5. METHODOLOGY

Study Design,

Cross sectional study.

Study Area

Muhimbili National Hospital Dental Clinics

Study Period

The study was conducted during the months of June-July 2008.

Study Population

All patients aged 15 years and above who met the inclusion criteria.

Sample Size and Procedure

The sample size was calculated from the formula $n = Z^2*p(1-p)/e^2$; were n = minimum sample size; Z= standardized normal deviate; p = prevalent of condition to be studied; e = allowable error. The proportion of the condition to be studied was set at 50% because there were no prior estimates for proportion of patients in need of RCT, quality of NS-RCT obturation or patients' satisfaction with NS-RCT. Using this formula, a minimum sample size was computed to be 384 patients.

Procedure for obtaining study participants

Consecutive patients who were attending the dental clinics at MNH from 5th June 2008 were considered for participation in the study until the pre determined sample size. Only those patients who met the inclusion criteria and consented to participate were recruited into the study. the inclusion criteria were (a) being a dental patient aged 15 years and above (b) having tolerable/no pain and (c) mentally healthy. The recruitment flow chart is summarized in figure 2 and was concluded by 31st July 2008 with total of 387 subjects enrolled into the study.

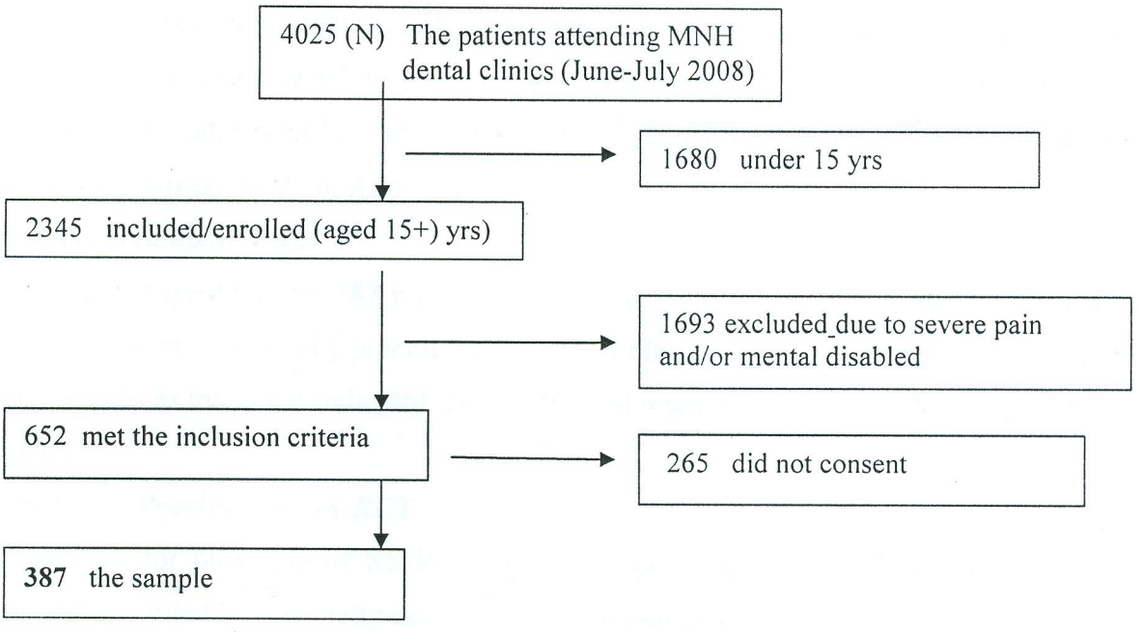


Figure 2. Participants recruitment flow chart

Ethical Issues

Ethical clearance was obtained from the Muhimbili University of Health and Allied Sciences Ethics and Research Committee on 5th June 2008 Ref No. MU/PGS/SAEC/Vol 11/86. All the patients were fully informed about the purpose of the study by giving or reading to them the informed consent form and they were assured that, any information related to them would be kept completely confidential. Those who were eligible and accepted to join the study were requested to sign a consent form before filling in the questionnaire or being subjected to any treatment. Those who were unable to sign were allowed to choose some one they trusted to sign on their behalf.

Data Collection

Patients' Socio-demographic Characteristics and Awareness

A structured pretreatment questionnaire in English (Appendix 2a) was translated into Swahili language (Appendix 2b) and used to collect data from patients who consented and included socio-demographic characteristics, awareness about NS-RCT. Demographic details were

according to a) sex, b) age, c), resident district (Kinondoni, Ilala and Temeke) and, d) educational level (no formal education, primary education, secondary education, and college education). Awareness of RCT among patients was determined using a dichotomous response (yes, no) and counterchecked using an open ended question about definition of RCT. The sources of information about RCT were also sought.

Patients' Treatment Needs

The treatment needs of the 387 interviewed patients were obtained from their treatment cards. The information provided by practitioners was recorded in a specially designed treatment forms (Appendix 3) as treatment indicated. Diagnosis, and treatment provided was also collected from the card.

Reasons for Provision of NS-RCT

The reasons for provision of NS-RCT by tooth type were gathered from patients' treatment cards and recorded in a specially designed form (Appendix4).

Types of teeth treated with NS-RCT

The tooth types were recorded according to FDI Tooth Notation for Permanent Teeth and recorded in designed form (Appendix4). The tooth types were later decoded as anterior teeth, premolars and molars and in relation to jaw type.

Quality of the Provided NS-RCT

Obturation quality of the performed NS-RCT was determined by using the post obturation periapical radiographs of all the treated teeth of all patients who received the treatment. To block the ambient light emanating from the viewer, the radiograph was placed into a slit made in a cardboard that was then placed over an illuminated x-ray viewer box (Dentsply Rinn Corp. Elgin, IL, USA). Assessment was based on location of GP in relation to canal wall and radiological apex of the root. *Distance of root filling from the radiographic apex* was measured directly from the post-obturation radiograph using a millimeter ruler. *Lateral seal* was categorized as adequate, if there was no radioluscence between the GP and the canal walls in the apical third of the canal; and inadequate, if there was radioluscence between GP and canal walls. *Apical seal* was categorized as *adequate,* if the distance from GP to apical constriction measured 0-2mm; and *inadequate*, if it was more than 2mm short of the constriction or if it had

passed through the apex into the periapical region. The overall obturation quality was considered *adequate* only if both lateral and apical seals were adequate (Appendix4). Principal investigator and one of the post graduate colleagues examined the x-rays, independently. The results were compared and a final consensus was agreed on. In cases of disagreement, a third colleague was asked to read the x-ray for final agreement.

Patients' Satisfaction with Provided NS-RCT

Patients were recalled seven days after obturation and after permanent filling to evaluate their satisfaction with the provided NS-RCT. Their satisfaction was assessed by means of a questionnaire (Appendix 5a) *that was translated into Swahili* (Appendix 5b). Using a five-point Likert scale (1=very satisfied to 5=very unsatisfied) patients were asked to rank to what extent they were satisfied with the provided NS-RCT. The variables used for evaluation were masticatory function and esthetic appearance of the treated teeth.

Efforts were made to ensure that all enrolled patients were re-evaluated even by phone.

Data Management and Analysis

The collected data were managed in a personal computer and analyzed using Epi info 6 version 6.04 (CDC, 2001). Data management included: daily data quality checks for inconsistencies, out of range values, wrong entries, etc. The *Pearson* chi-square test (χ^2) was used to compare differences (proportions) in variables on the provision of NS-RCT at the MNH dental clinics. The level of significance was set at p-value ≤ 0.05.

6. RESULTS

Study participants and socio-demographic variables

A total of 387 patients with median age 34 years (age range of 15-83 years) were recruited into the study. Majority of the participants were females (56.6%). There were few patients in age group 65-83 years; other age groups were nearly similar ranging from 20.7-26.9%. Nearly two thirds (62.8%) of the patients had a high level of education (secondary or college education) and slightly more than half (56.1%) came from Kinondoni district (Table 1).

Table 1: Distribution of the 387 patients by socio-demographic variables (N=387)

Socio-demographic variables	n	(%)
Sex		
Female	219	56.6
Male	168	43.4
Age groups (yrs)		
15-24	101	26.1
25-34	104	26.9
35-44	79	20.4
45-64	80	20.7
65-83	23	5.9
Educational level		
Low	144	37.2
High	243	62.8
Residence district		
Kinondoni	217	56.1
Ilala	103	26.6
Temeke	67	17.3

Patient Awareness, Knowledge and Sources of Information on NS-RCT

Out of 387 patients only 25.6% patients were aware of RCT. Patients with high level of education showed, significantly, more awareness (31.7%) about RCT than patients with low level of education (p=0.001) (Table 2).

Majority of the patients received information on NS-RCT from dental personnel (80.7%) with no statistically significant differences on the acquisition of this information between the sexes, age groups or levels of education (Table 3). Age groups 65 years to above were less aware (21.7%) than other age groups (table 3).

Table 2. Distribution of participants by awareness on NS-RCT, source of information on NS-RCT, sex and level of education. Percentage in parenthesis

	Sex			Level of education		
Awareness	**Male**	**Female**	**Total**	**Lower**	**High**	**Total**
- aware	42 (25)	57 (26.0)	99 (25.6)	22 (15.3)	77 (31.7)	99 (25.6)
- not aware	126 (75)	162 (4.0)	288 (74.4)	122 (84.7)	166 (68.3)	288 (74.4)
Total	168 (100)	219 (100)	387 (100)	144 (100)	243 (100)	387 (100)
Statistics	$x^2 = 0.05$; $df = 1$; $p = 0.818$			$x^2 = 12.79$; $df = 1$; $p = 0.001$		
Source of information						
- dental personnel	64 (83.1)	78 (78.8)	142 (80.7)	42 (89.4)	100 (77.5)	142 (80.7)
- media	2 (2.6)	5 (0.5)	7 (5.4)	0 (0.0)	7 (5.4)	7 (4.0)
- relatives & friends	11 (14.3)	16 (16.2)	27 (15.3)	5 (10.6)	22 (17.1)	27 (15.3)
Total	77 (100)	99 (100)	176 (100)	47 (100)	129 (100)	176 (100)
Statistics	$x^2 = 0.87$; $df = 2$; $p = 0.65$			$x^2 = 4.7$; $df = 2$; $p = 0.130$		

Table 3. Distribution of participants by awareness on NS-RCT, source of information on NS-RCT and by age. Percentage in parenthesis

	Age groups (years)					
Awareness	15-24	25-34	35-44	45-64	65+	Total
- aware	23 (22.8)	31 (29.8)	22 (27.8)	18 (22.5)	5 (21.7)	99 (25.6)
- not aware	78 (77.2)	73 (70.2)	57 (72.2)	62 (77.5)	18 (78.3)	288 (74.4)
Total	101 (100)	104 (100)	79 (100)	80 (100)	23 (100)	387 (100)
	Statistics for all $x^2 = 2,19$; *df* =4; *p* =0.7					
Source of information						
- dental personnel	32 (72.7)	42 (80.8)	32 (86.5)	32 (84.2)	4 (80)	142 (80.7)
- media	2 (4.6)	1 (1.9)	2 (5.4)	2 (5.3)	0 (0.0)	7 (4.0)
- relatives & friends	10 (22.7)	9 (17.3)	3 (8.1)	4 (10.5)	1 (20)	27 (15.3)
Total	44 (100)	52 (100)	37 (100)	38 (100)	5 (100)	176 (100)
	Statistics for all $x^2 = 14.12$; *df* =12; *p* = 0.29					

6.3 Distribution of Patients according to Oral Treatment Needs

Patients treatment need were found to be mainly NS-RCT (n=128; 33.1%), followed by extraction (22.7%). Conservation (Filling and RCT) comprises (50.1%).

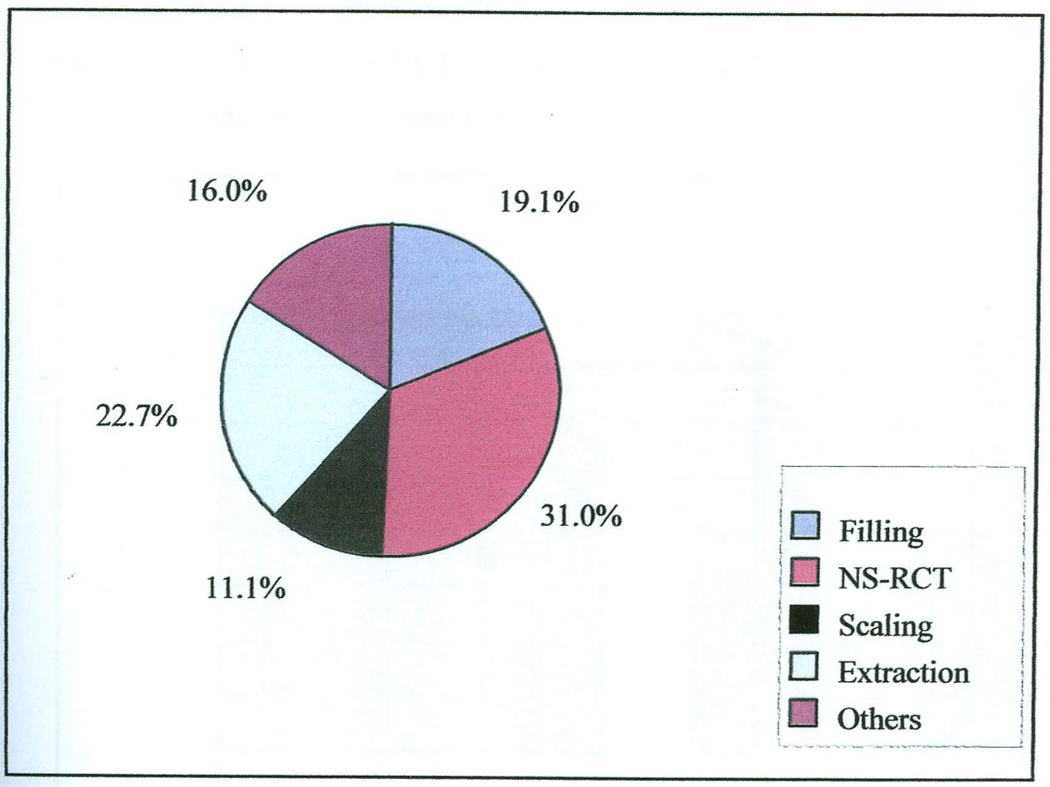


Figure 3. Distribution of patients according to oral treatment needs (N=387).

Proportion of Patients in Need of NS-RCT according to Age and Sex

Figure 4 gives the distribution of patients who were in need of NS-RCT by sex and age. About two thirds (63.3%) of the patients in need were females (Figure 4). Comparatively, similar sex differences, with more female than male patients, showed need for NS-RCT in all age groups. However, the differences were not statistically significant. Slightly over one third (35.2%) of the patients in need of NS-RCT were of the age group 25-34 yrs. There were no patients in need of NS-RCT among the 65+ year olds.

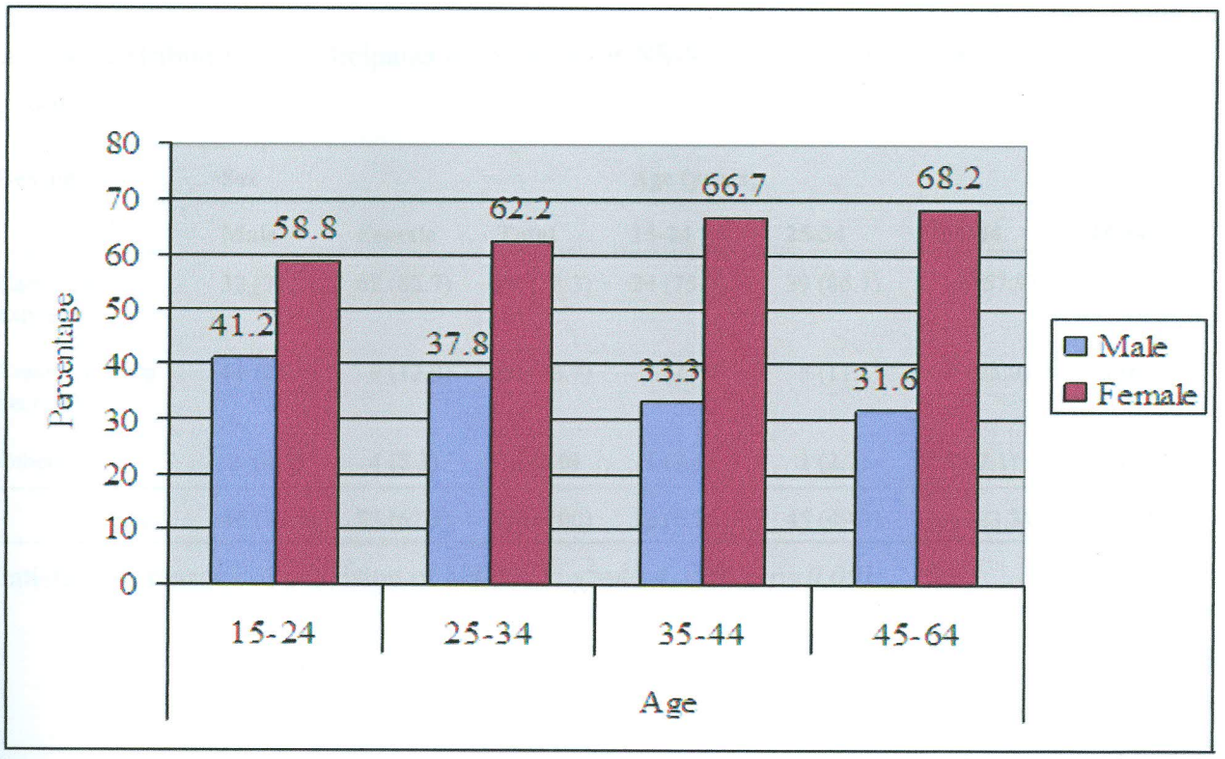


Fig. 4. Distribution of patients in need of NS-RCT by sex and age (*p=0.879*) (N=128).

Reasons for Providing NS-RCT

Tables 4 show the reasons for providing NS-RCT by sex and age. Out of the 128 patients in need of NS-RCT, eight did not receive the treatment owing to various reasons. Dental caries was the most common reason for providing NS-RCT (78.3%), slightly more among female than male patients (82.7% and 71.1 %) and almost evenly distributed in all age groups. The second common reason for providing NS-RCT was by traumatic pulp necrosis (16.7%) which was more prevalent among male patients (24.4%) and age group 35-44 years (25.0%). There was statistically significant differences between reasons for provision of NS-RCT (*p=0.001*)

Table 4: Distribution of participants by reasons for NS-RCT and by sex and age. Percentages in parenthesis

Reason	Sex			Age (years)			
	Male	**Female**	**Total**	**15-24**	**25-34**	**35-44**	**45-64**
Caries pulp exposure	32 (71.1)	62 (82.7)	94 (78.3)	24 (75.0)	39 (86.7)	19 (67.9)	12 (80.0)
Traumatic pulp necrosis	11 (24.4)	9 (12.0)	20 (16.7)	7 (21.9)	5 (11.1)	7 (25.0)	1 (6.7)
Others	2 (4.5)	4 (5.3)	6 (5.0)	1 (3.1)	1 (2.2)	2 (7.1)	2 (13.3)
Total	45 (37.5)	75 (62.5)	120 (100)	32 (6.7)	45 (49.2)	28 (23.3)	15 (12.5)

Statistics for reasons of provision of NS-RCT: $\chi^2=40.4$, *d.f=2, p=0.001*

Dental caries was most common reason for NS-RCT in molars (maxillary 94.1% and mandibular 90%) followed by premolars (maxillary 89.7% and mandibular 83.3%). Further more dental caries was more in the maxilla (n=67; 55.8%) than in mandible (n=27; 44.2%), however, the difference was not statistically significant (p=0.34) (Table 5). Traumatic pulp necrosis was more common in maxillary anterior teeth (34.1%).

Table 5: Distribution of participants by reasons for NS-RCT, jaw and tooth types. Percentage in parenthesis, n=120.

Reasons	**Maxilla**			**Mandible**			
	Molar	**Premolar**	**Anterior**	**Molar**	**Premolar**	**Anterior**	**Total**
Caries pulp exposure	16 (94.1)	26 (89.7)	25 (56.8)	18 (90)	5 (83.3)	4 (100)	94 (78)
Traumatic pulp necrosis	1 (5.9)	2 (6.9)	15 (34.1)	1 (5)	1 (16.7)	0 (0))	20 (17)
Others	0 (0)	1 (3.4)	4 (9.1)	1 (5)	0 (0)	0 (0)	6 (5.0)
Total	17 (100)	29 (100)	44 (100)	20 (100)	6 (100)	4 (100)	120 (100)

Distribution of teeth treated with NS-RCT by tooth type and jaw type

Slightly more than one third of all teeth treated were the anteriors 40% (maxillary: n=44; 36.7% and mandibular: n=4; 3.3). Molars were second 30.8% (maxillary: n=17; 14.2% and mandibular: n=20; 16.7%). More maxillary teeth (75.0%) than mandibular teeth (25%) were treated, the difference being highly significant (*p=0.001*) (Table 6).

Table 6. Distribution of teeth treated with NS-RCT by tooth and jaw types

Tooth type	**Jaw type**		
	Maxilla	**Mandible**	**Total**
Anterior	44 (36.7)	4 (3.3)	48 (40.0)
Premolar	29 (24.2)	6 (5.0)	35 (29.2)
Molar	17 (14.2)	20 (16.7)	37 (30.8)
Total	90 (75.0)	30 (25.0)	120 (100)

Statistics: differences - maxilla vs. mandible: $\chi^2=23.2$, $d.f=1$, $p=0.001$

differences - tooth type : $\chi^2=1.42$, $d.f=2$, $p=0.49$

Radiographic Quality of Provided NS-RCT

Obturation was adequate for both apical and lateral seal in (65%) of obturated teeth with premolars (82.9%) being most adequately obturated closely followed by anterior teeth (70.8). Apical seal was adequate (within 2 mm of the radiographic apex) in 68.3% of the obturated teeth. Premolars were again most adequately obturated followed by anterior teeth (88.6% and 70.8%) respectively. Lateral seal was adequate in 75% of the obturated teeth, anterior teeth being significantly most adequately obturated (93.7%) of all teeth, followed by premolars (85.7%). Molars were poorly obturated in all aspects (about 40%). All the differences were highly statistically significant *(p=0.001)*. However, there was no significant difference in obturation quality between maxillary and mandibular teeth.

Table 7. Distribution of obturation quality by tooth type. Percentage in parenthesis

Obturation Quality	**Tooth type**			**Total**
	Anterior (n=48)	**Premolar (n=35)**	**Molar (n=37)**	
Overall				
adequate	34 (70.8)	29 (82.9)	15 (40.5)	78 (65.0)
inadequate	14 (29.2)	6 (17.1)	22 (59.5)	42 (35.0)
	χ^2=1.42; d.f=2; p=0.0.49			
Apical seal				
adequate	34 (70.8)	31 (88.6)	17 (46.0)	82 (68.3)
inadequate	14 (29.2)	4 (11.4)	20 (54)	38 (31.7)
	χ^2=8.8; d.f=2; p=0.01			
Lateral seal				
adequate	45 (93.7)	30 (85.7)	15 (40.5)	90 (75)
inadequate	3 (6.3)	5 (14.3)	22 (59.5)	30 (25)
	χ^2=22.5; d.f=2; p=0.001			

Patients satisfaction with the provided NS-RCT

The overall patient satisfaction with the provided NS-RCT was 96.6%. Whereas satisfaction with *mastication* (chewing) with the treated teeth was 97.5%, satisfaction with appearance was 90.8% (Table 8). Differences in reported satisfaction with provided NS-RCT between sexes, age groups, and levels of education were not statistically significant.

Table 8. Distribution of patients' satisfaction with NS-RCT according to sex, age and education

Satisfaction	Sex		Age groups (yrs)		Level of education		Total (120)
	Male (n=45)	Female (n=75)	15-34 (n=77)	35-64 (n=43)	Low (n=35)	High (n=85)	
Overall satisfaction							
satisfied	43 (95.6)	73 (97.3)	75 (97.4)	41 (95.3)	35 (100)	81 (95.3)	116 (96.7)
dissatisfied	2 (4.4)	2 (2.7)	2 (2.6)	2 (4.7)	0 (0)	4 (4.7)	4 (3.3)
Satisfaction with mastication							
satisfied	43 (95.6)	74 (98.7)	76 (98.7)	41 (95.3)	35 (100)	82 (96.5)	117 (97.5)
dissatisfied	2 (4.4)	1 (1.3)	1 (1.3)	2 (4.7)	0 (0)	3 (3.5)	3 (2.5)
Satisfaction with appearance							
satisfied	43 (95.6)	66 (88.0)	71 (92.2)	38 (88.4)	32 (91.4)	77 (90.6)	109 (90.8)
dissatisfied	2 (4.4)	9 (12.0)	6 (7.8)	5 (11.6)	3 (8.6)	8 (9.4)	11 (9.2)

15-34 years = young adults 35-64 years = old adults

Main reason for dissatisfaction with appearance was discoloration still present (88.8%).

Main reason for dissatisfaction with mastication was pain upon mastication (100%)

7. DISCUSSION

This study utilized data collected in a cross-sectional study that included an interview and questionnaire, clinical records, radiographic examinations as well as treatment. Of 2345 patients aged 15 years to above, 1693 were excluded because they were in severe pain or mentally disabled. Those in severe pain were judged due to their agony appearance and failure to co-operate while those with mental disability were known from their parents/guardians; since the were objective of measuring awareness about NS-RCT, reading and signing the informed consent form before any clinical intervention it was impossible to include those patients in the study. Out of 625 (62%) patients who met the inclusion criteria, 387 consented to the study and were included. MNH was selected as a study area, because it is a teaching hospital of MUHAS and the only largest referral and national hospital in Tanzania rendering many specialty services, including NS-RCT. Further more MNH is located in Dar es Salaam, the main commercial city in the country with the largest population. The residents of the city have different socio-demographic characteristics making them more likely to represent the Tanzania general population. Unlike other clinics, MNH dental services does not necessitate referral letter from other hospitals, making it accessible to many patients in need without any complications.

In this study, several measures to ensure high good quality of the collected data were taken into consideration. The measures included a two day pilot study with instruction sessions to recorders and repeated checks during data entry and processing. The investigators and a post graduate student examined the x-rays, independently. The results were compared, differences in decisions discussed and consensus agreed upon. In cases of serious disagreement, a third person was asked to read the x-ray for final disposal. It is, however, important to point out that the radiographs used in this study were not taken in standardized manner; the inevitable changes in beam/film angulations might have affected the images of teeth (Fava and Dummer. 1997). Despite this shortcoming the information is however, both interesting and valuable.

The observed low level of awareness (25.6%) on NS-RCT among the sample indicate that majority of patients do not get information when they visit dental clinics or by any other means

such as mass media. Kikwilu et al., (2009) reported five major barriers to restorative care among which included "lack of knowledge on restorative care" and "lack of advice from dentists". Patients with high level of education showed significantly more awareness than patients with low level of education (p=0.01). This correlates well with the results that significantly more patients with high education level than low education (*p=0.001*) were more aware about RCT. Paulander et al., (2003) in their study to evaluate the association between educational level and dental disease, treatment needs and oral hygiene habits, also found that educational level was shown to influence the oral conditions. Age groups 65+ were less aware (21.7%) than other age groups. This was expected as these patients during their youth, in 1964 and earlier RCT services were not available in the country.

The observed high need for NS-RCT (33.1%) among patients attending MNH dental clinics indicates that majority of patients visit dental clinics when the pathology in many cases dental caries has progressed to irreversible pulp damage. This can be attributed to the fact that patients do not usually go for dental check-ups as has been observed by Kikwilu et al., (2009).

The high need for NS-RCT of 63.3% observed among females in this study is similar to that observed by Zaatar et al., (1997) in Kuwait, Kirkevang et al., (2001) in Denmark and Ajayi and Ajayi (2007) in a Nigerian teaching hospital. This indicates that females with irreversible pulp damage visit dental clinics more frequently than males. Stabholz et al., (1998) report the drive for esthetics to be higher among females than males leading to female frequent dental visits,

The high need for NS-RCT (35.2%) appeared in the age groups of 25-34 years. This indicate that the level of awareness about NS-RCT is high among these age groups as observed in this study and therefore they are so likely to look for the treatment.

It was also observed that, there was no patient in need of NS-RCT in participants aged 65 years and above. This implies that there are few teeth indicated for NS-RCT in these age groups. Another reason might be that these age groups are less aware about NS-RCT as observed in this study, and so less likely to look for the treatment.

Caries involving the pulp followed by traumatic pulp necrosis were observed as the most common reasons for NS-RCT by 78.4% and 16.7%, respectively. This shows that dental caries

and trauma are the leading cause of irreversible pulp damage. The observation is in agreement with Bjørndal, (2006) in Denmark and Oderinu et al., (2006) in Nigeria, both reported dental caries as the most common reason for endodontic treatment followed by traumatic pulp damage.

Caries involving the pulp was observed to be the most common reason for NS-RCT in molars (maxillary 94.1% and mandibular 90%) followed by premolars (maxillary 89.7% and mandibular 83.3%). This agrees with study a by Oderinu et al., (2006), which also confirmed dental caries as the most common reason for endodontic treatment in the posterior teeth. This suggests that most patients with posterior teeth caries report to dental clinics when caries have progressed to irreversible pulp damage and pain or discomfort is intolerable.

Traumatic pulp necrosis, the second reason for NS-RCT, was more common in the male patients (24.4%) and in the age groups of 35-44 years (25.0%) and in the upper anterior teeth. This observation agrees with studies by Häyrinen-Immonen et al., (2006); Kaba and Marechauxs (1989). The reason might be because young males are normally much more involved in dangerous/trauma inflicting sports, road traffic accidents and violence as compared to females (Häyrinen-Immonen et al., 2006). Upper anterior teeth were more affected by traumatic pulp necrosis than the rest of the teeth (34.1%). Similar findings were reported by Adeleke and Comfort (2007) in their study, in which of the 168 traumatized discoloured anterior teeth 167 were maxillary incisors; 150 central incisors, 17 lateral incisors and 1 mandibular central incisor. Upper anterior teeth are at increased risk to traumatic injury because of their location; under normal circumstances upper anterior overlap lower ones and are therefore prone to trauma as in falling with face down, knocked in road traffic accidents or even violence.

Maxillary teeth were significantly more treated with NS-RCT (75%) than mandibular teeth 25%; this is in agreement with a study done in Nigeria by Ajayi and Ajayi (2007) who reported that, maxillary teeth were treated more than mandibular teeth. Similar finding were also reported by Gulsahi et al. (2008) who found statistically significantly more root-filled teeth in the maxilla (62.3%) than in the mandible (37.7%). Also Peak et al. (2001) in their study, found that 59% (n=241) were maxillary teeth and 41% (n=165) mandibular teeth. It was also observed that anterior teeth were treated more than other teeth. This is in agreement with Iqba et al.

(2005) in a study to identify the most commonly treated tooth at a postgraduate endodontics program at the University of Pennsylvania School of Dental Medicine, who reported anterior teeth being 1.4 times more likely to undergo NS-RT than molars. This can be attributed to the fact that, due to their location, the maxillary teeth, and especially anterior ones, are most visible during smiling and talking making them easily noticed. For aesthetic reasons, should these teeth become discoloured or carious, the patient is forced to look for dental treatment and accept RCT if indicated. Another reason might be the maxillary teeth are easily accessible for endodontic treatment, making dental practitioners to prefer treating them.

It was also found that, slightly more than one third of all teeth treated were the anteriors 40% with major component being maxillary anterior teeth (36.7%). This suggests that anterior teeth are given prime priority for endodontic treatment by both patients and practitioners. Due to their location anterior teeth are of esthetic concern to the patients so patients prefer their restoration against extraction, on the other hand dentists prefer to them endodontically because they are easily accessible for root canal instrumentation. Molars were observed to be secondly common with 30.8% of all teeth treated. This signifies that despite the fact that they are more affected by caries involving the pulp than rest of the teeth, they are not of prime choice for NS-RCT by both patients and or practitioners. Unlike findings reported in our study, Kirkevang et al., (2001) and Bjørndal, (2006) reported that the most commonly treated teeth with NS-RCT were molars. This difference can be attributed to the fact that, the later studies were done in developed countries, where patients are likely to be more knowledgeable about the importance of maintaining all of their teeth irrespective of their location. On the operators side the availability of endodontic specialists and modern instruments in developed countries makes all teeth almost accessible for instrumentation, thus treatment is likely to base on total functional need rather than accessibility for instrumentation or esthetics.

Obturation quality of teeth treated with NS-RCT in this study revealed that a big proportion (65%) were adequate in both apical and lateral seals. This is in agreement with findings by Bołtacz-Rzepkowska and Pawlicka (2003), who reported on findings in a study done in Poland that evaluated radiographic features and outcome of RCT among attending patients and found that 64% of RCT were adequately filled. Rafeek et al. (2009) at the School of Dentistry,

University of the West Indies in Trinidad and Tobago also found 72.2% of root filled canals had adequate length, density (lateral seal) and taper. In regard to apical seal 68.3% were categorized as being adequate. Similar findings were reported by Barrieshi-Nusair (2004) in Jordan, where she assessed radiographic technical quality of root canal treatment at the Dental Teaching Center and reported that sixty one percent of the obturated teeth had adequate root fillings with acceptable apical seal. The observed similarities in the various studies may be attributed to the fact that, all of them were conducted in dental teaching institutions which are likely to be manned by qualified personnel, and with adequate equipments, instruments and materials. However, these findings slightly differ from the 50% adequacy reported by Peak et al. (2001) in the UK air force base, and also 49% by Bołtacz-Rzepkowska and Pawlicka (2003) in the Łódź region of Poland public hospitals. This difference may be due to the fact that, these studies were not done in teaching hospitals. Premolars and anterior teeth were the most adequately obturated teeth (82.9%% and 70.8%) respectively. This is explained by the fact that, these teeth have single or two root canal(s), which are relatively wide and straight, when this is coupled with their anterior location they are much easier to obturate as compared to molars. Molar teeth usually have three or more canals which are relatively small, narrow and almost always curved; this when coupled with their location (far posterior) makes them difficult to manage. Lack of visual aids and apical locators and other modern endodontic instruments in our clinical setting complicates the situation even further. Peak et al., (2001) also gave similar explanation i.e. access is better at the front of the mouth and the root canal anatomy is usually more amenable to treatment, i.e. straight and more circular allowing better cleaning and simpler obturation. Multi-rooted teeth with curved root canals present more of a challenge in all stages of root canal treatment and their higher failure rates may be due to factors other than filling technique alone, e.g. lack of access, poorer cleaning, accessory anatomy.

The observed high percentage of patients' satisfaction with the provided NS-RCT of 96.6% is in accordance with those reported by Salehrabi and Rotstein (2004) in USA, who found satisfaction with endodontic treatment to be 97%; and Gõrduysus and Gõrduysus (2000) in Ankara, who reported 82% satisfaction. This implies that root canal therapy meets patients' expectations of freedom from pain and regaining masticatory and esthetic functions. However,

high satisfaction with the provided NS-RCT, especially in mastication which was determined by asking the patients if they were using the treated tooth may be linked to the short duration of assessment (seven days) since even emergency pulpotomy can as well give similar results after six weeks (Nyerere et al., 2006). It may no be reasonable to assess satisfaction after seven days but restoration of chewing ability and form of tooth even if it is for seven days is valuable and may indicate good prognosis though not necessarily success. Even if it was not statistically significant females were less satisfied than males. Probably this was compounded with high expectations from female patients that RCT would also take care of their esthetic needs. These explanations also enhance the finding in this study that the major reason for dissatisfaction among female was persistent discoloration an indication for esthetic concern. It should also be remembered that majority of treated teeth were maxillary anterior teeth, these teeth are the most visible during smiling and speaking and much more exposed to trauma. Dissatisfaction in appearance could also be attributed to incomplete removal of carious materials, or in doing root canal treatment in discolored necrotic anterior teeth without bleaching and may be that is why persistent discoloration was the main reason for dissatisfaction with appearance.

8. CONCLUSIONS

- From this study it is concluded that, more than two thirds of patients were not aware of NS-RCT
- Caries pulp exposure was the main pathology that led to NS-RCT
- Overall, 65% of the root canal treated teeth had their canals adequately sealed both apically and laterally.

9. RECOMMENDATIONS

1. Community education is required to raise the awareness about NS-RCT.
2. Improvement of dentists' skill in treatment of molar teeth and acquisition of modern endodontic equipment and instruments.
3. More and long term studies evaluating the provision and treatment out-come of NS-RCT in the country are need.

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11. APPENDICES

Appendix 1a

MUHIMBILI UNIVERSITY OF HEALTH AND ALLIED SCIENCES, MUHAS
DIRECTORATE OF RESEARCH AND PUBLICATIONS

PATIENT INFORMED CONCENT FORM

ID-NO | | | | | | | | | | |

Consent to participate in a study about provision of "Non-Surgical Root Canal Therapy" at Muhimbili National Hospital

Greetings! My name is ..... and I am a Dental nurse/Auxiliary working on this research project of assessing the provision of non-surgical root canal therapy.

Purpose of the study

We are conducting this study to find out how "non-surgical root canal therapy" is provided at Muhimbili National Hospital and what the outcomes of the service are.

What participation involves

If you agree to join the study, you will be required to answer questions, to be interviewed, be examined, and be treated according to the available treatment options in regard to your problem. If you will receive "non-surgical root canal therapy", you will be recalled seven days after completion of treatment for post treatment interview.

Confidentiality

All information we collect will be entered into computers with only the study identification number.

Risks

We do not expect that any harm will happen to you because of joining this study. However if you will undergo "Non-surgical Root Canal Therapy", some complications may occur like in any others treatment options available.

Right to Withdraw and Alternatives

Taking part in this study is completely your choice. If you choose not to participate in the study or if you decide to stop participating in the study you will continue to receive all services that you would normally get from this hospital. You can stop participating in this study at any time, even if you have already given your consent. If you miss some visits for any reasons but wish to come back into the study, we will be ready to accept you and continue giving you our services as usual. Refusal to participate or withdrawal from the study will not involve penalty or loss of any benefits to which you are otherwise entitled.

Benefits

If you agree to take part in this study, you may not benefit directly from this study. However like all participants in the study, you will benefit by knowing the available different dental treatment options to your problem from our dentists and get the best available treatment. For those who will undergo root canal therapy will benefit by retaining their teeth which could otherwise have been extracted. We hope the information we learn from this study will benefit others.

A small group of experts who are not involved in implementing this study will monitor the results of this study and how we conduct the research. We will tell you about the new information from this or other studies that may affect your health, welfare or willingness to stay in the study.

In case of injury

We do not expect that any harm will occur to you as a result of participation in this study. However, if any physical injury resulting from participation in this research should occur, we will provide you with treatment according to the current standard of care in Tanzania. There will be no more compensation to you.

Who to contact

If you ever have questions about this study, you should contact the Principal investigator Dr. A. M. Rukoma, Muhimbili University of Health and Allied Sciences, P. O. Box 65001, Dar es Salaam. Cel: 0786 987 153 or 0777 346 811. If you ever have questions about your rights as a participant, you may call Prof. E. F. Lyamuya, Chairman of the Senate Research and Publications Committee, P. O. Box 65001, Dar es Salaam. Tel: 2150302-6.

Signature

Do you agree?

Participant agrees..... Participant does NOT agree.....

I, _____ have read the contents in this form. My questions have been answered. I agree to participate in this study.

Signature of participant _____

Signature of witness (if participant can not read) _____

Signature of research assistant _____

Date of signed consent _____

Appendix 1b

MUHIMBILI UNIVERSITY OF HEALTH AND ALLIED SCIENCES (MUHAS)

DIRECTORATE OF RESEARCH AND PUBLICATIONS

FOMU YA RIDHAA YENYE UFAHAMU

Namba ya Usaili | | | | | |

Ridhaa kushiriki katika utafiti kuhusu huduma inayohusu matibu ya kiini cha jino "Non-Surgical Root Canal Therapy" katika Hospitali ya Taifa Muhimbili.

Salamu! Jina langu ni .... na ni nesi/mhudumu, katika tiba na utafiti wa magonjwa ya kinywa na meno, nikifanya katika mradi huu wa "utafiti kutathimini huduma ya matibabu ya kiini cha jino".

Lengo la utafiti

Tunafanya utafiti huu ili kuchunguza namna gani matibabu ya kiini cha jino yanavyotolewa katika Hospitali ya Taifa Muhimbili, na pia ni matokeo gani yanayotokana na huduma hii.

Ushiriki unahusisha nini

Kama utakubali kushiriki utafiti huu, utahitajika kujibu maswali, kuhojiwa, kuchunguzwa na utatibiwa kutumia mifumo ya matibabu iliyopo kulingana na tatizo lako. Kama utapata matibabu ya kiini cha jino, utahitaji kurudi siku ya saba baada ya matibabu kwa ajili ya mahojiano.

Usiri

Taarifa zitakazokusanywa zitaingizwa kwenye komputa zikiwa na namba ya utambulisho tu (majina hayataingizwa kwenye komputa).

Uwezakano wa madhara

Hatutegemei madhara yoyote yatakutokea kutokana na ushiriki wako katika utafiti huu, Hata hivyo kwa wale watakao patiwa matibabu ya kiini cha jino wanaweza kupata madhara kidogo kama ilivyo kwa matibabu mengine yanayotolewa.

Haki ya Kujiondoa na njia-mbadala

Kushiriki katika utafiti huu ni chaguo lako kabisa. Kama utachagua kutokushiriki au ukiamua kusitisha ushiriki wako katika utafiti huu, utaendelea kupata huduma zote ambazo kwa kawaida ungepata kutoka hospitali hii. Unaweza kusitisha ushiriki wako wakati wowote hata kama umekwisha toa ridhaa ya kushiriki. Kama utashindwa kujitokeza pale unapohitajika kwa sababu yeyote ile na unapenda kurudi tena kwenye utafiti, tutakuwa tayari kukupokea na kuendelea kukupa huduma zetu kama kawaida. Kutokukubali kushiriki au kujiondoa kwenye utafiti hakutahusisha adhabu au upotevu wa faida zozote ambazo ni stahili yako.

Faida

Kama utakubali kushiriki katika utafiti huu, yawezekana usipate faida ya moja kwa moja. Hata hivyo, kama washiriki wengine kwenye utafiti huu, utanufaika kwa kujua matibabu ya meno aina mbali mbali mbadala yanayopatikana kwa ajili ya tatizo lako kutoka kwa wataalamu wetu na pia kupata matibabu ya uhakika yaliyopo. Kwa wale watakao tibiwa kiini cha jino watanufaika kwa kubakiza meno kinywani, meno ambayo vinginevyo yangeweza kungolewa. Tunatumai taarifa zitakazotokana na uchunguzi huu zitawanufaisha wengine.

Kundi dogo la wataalamu ambao hawahusiki na utafiti huu, watafuatilia matokeo yake na namna tunavyoendesha utafiti huu. Tutakujulisha kuhusu taarifa mpya zitokanazo na utafiti huu au tafiti zingine zinazoweza kudhuru afya yako, ustawi wako na utashi wako kukaa kwenye utafiti.

Kama itatokea madhara

Hatutarajii madhara yoyote yatatokea dhidi yako kwa kushiriki utafiti huu. Hata hivyo ikiwa yakatokea, tutatoa matibabu kulingana na kiwango cha sasa cha matibabu yanayotolewa Tanzania na hivyo hakuna fidia zaidi itakayotolewa kwako.

Nani wa kuwasiliana nao

Kama una swali lolote kuhusu utafiti huu, wasiliana na mtafiti mkuu, Dk. A.M. Rukoma, Chuo Kikuu cha Sayansi za Afya na Sayansi-shiriki Muhimbili, Sanduku la Posta 65001, Dar es Salaam, Simu: 0786 987 153 au 0777 346 811. Unaweza pia kuwasiliana na Profesa E. F. Lyamuya, Mwenyekiti wa Kamati ya Seneti Utafiti na Uchapishaji ya Chuo, Sanduku la Posta 65001, Dar es Salaam. Simu: 2150302-6.

Saini

Je, unakubali?

Mshiriki ANAKUBALI ..... mshiriki HAKUBALI.....

Mimi, _____nimesoma yaliyomo kwenye fomu hii na maswali yangu yamejibiwa. Nakubali kushiriki katika utafiti huu.

Sahihi ya mshiriki _____

Sahihi ya shahidi (kama mshiriki hawezi kusoma) _____

Sahihi ya mtafiti msaidizi _____

Tarehe ridhaa iliposahiniwa _____

Appendix 2a ***(English version)***

PROVISION OF NON-SURGICAL ROOT CANAL THERAPY (NS-RCT)

AT THE MUHIMBILI NATIONAL HOSPITAL

<u>Pre-treatment</u> questionnaire to evaluate Awareness and Need for non-surgical root canal treatment

---

ID. [_|_|_] Patient Reg. No._____ Date __/__/ 2008 CLINIC *(Grade IV=1, IPPM =2)* [_]

Gender *(Male=1, Female=2)* [_] Date of birth *(yr,mo,day)* [_|_|_|_|_|_] Age *(yrs)* [_|_]

Residence district *(Kinondoni=1, Ilala=2, Temeke=3)* [_] Tel. _____

---

1. Marital status
    a) Married
    b) Single
    c) Separated [_]
    d) Divorced
    e) Widow / widower
2. Level of education
    a) No formal education
    b) Primary education [_]

c) Secondary education

d) Post secondary education

3. Occupation/employment _____

4. For what reason do you need to see a dentist today?

a) Dental check up

b) Cavitated tooth

c) Gum problems

d) Toothache

e) Discolored tooth [_]

f) Swelling

g) Dry mouth

h) Artificial teeth,

i) Others (specify) _____

5. Do you perceive a need for dental treatment? *(yes=1, no=2)* [_]

6. If yes, state the *kind of treatment*

a) Root canal treatment/therapy (RCT)

b) Tooth filling

c) Teeth whitening

d) Reduction and fixation [_]

e) Free of pain

f) Free of swelling

g) Tooth extraction

h) Artificial teeth

i) Others specify_____

7. Are you aware of "Root Canal Treatment" *(yes=1, no=2)* [_]

8. If yes, how/where (source) did you come to know about it?

a) From dental health workers

b) From TV

c) Form the internet [_]

d) From relatives / colleagues

e) Others source (specify): _____

9. What is root canal treatment? _____

10. Do you think you need "Root Canal Treatment" during this visit? *(yes = 1, no = 2)* [_]

11. If yes, why? _____

12. If no, why? _____

Appendix 2b ***(Swahili version)***

HUDUMA NA UTAFITI KUHUSU MATIBABU YA MENO,

KWA NJIA YA KUTIBU KIINI CHA MZIZI WA JINO "RCT", MNH

<u>Dodoso kabla ya matibabu</u> kutafuta ufahamu juu ya matibabu
ya njia ya kiini cha jino na hitaji/haja ya matibabu ya haya

KLINIKI _____

Na. ya utambulisho [__|__|__] Na. ya usaili _____ Tarehe __/__/2008

Jinsi *(me=1, ke=2)* [_] Tarehe ya kuzaliwa *(mwk,mwz,tarehe)* [__|__|__] Umri (miaka): [_]

Maskani - wilaya *(Kinondoni=1, Ilala=2, Temeke=3)* [_] Simu:.....

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1. Hali ya kuwa na ndoa
    1) Ameolewa/ameoa
    2) Hajaolewa/hajaoa [_]
    3) Wametengana
    4) Wameachana
    5) Mjane

2. Kiwango cha elimu
    1) Hana elimu

2) Elimu ya Msingi [_]
3) Elimu ya Sekondari
4) Elimu baada ya sekondari

3. Ajira/kazi: _____

4. Kwa nini unatahitaji kumuona daktari wa meno?
   1) uchunguzi wa kawaida wa meno
   2) jino limetoboka
   3) matatizo ya fizi
   4) jino linauma [_]
   5) jino limegeuka rango
   6) matatizo ya taya
   7) mdomo kukauka
   8) uvimbe
   9) meno bandia
   10) mengineyo (taja) _____

5. Kama jibu ni ndiyo, eleza eleza aina ya tatizo ulilo na
   1) naitikia wito
   2) jino limetoboka
   3) matatizo ya fizi
   4) jino linauma [_]
   5) jino limegeuka langi
   6) uvimbe
   7) mdomo unakauka
   8) meno bandia
   9) mengineyo (elezea)_____

6. Je, unahisi haja ya kutibiwa meno? (ndiyo=*1, hapana=2)*

7. Kama ndiyo, eleza aina ya matibabu unayohitaji?
   1) matibabu ya kiini cha mzizi wa jino (RCT)
   2) kuziba jino [ ]
   3) kusafisha meno
   4) kufunga taya lililovunjika
   5) kuondokana na maumivu
   6) kuondokana na uvimbe
   7) kung'oa jino
   8) meno bandia
   9) mengineyo (taja)_____

8. Je, unayatambua/unajua matibabu ya kiini cha mzizi wa jino (RCT)?
   (ndiyo=1, hapana) [ ]
9. Kama jibu ni ndiyo, Je, ulipataje au ulipata wapi habari hii ?
   1) ktoka kwa watabibu wa meno
   2) matangazo kwenye TV
   3) kupitia kwenye mtandao [ ]
   4) kutoka kwa ndugu/jamaa
   5) chanzo Kingine (eleza): _____
10. Matibabu ya kiini cham zizi wa jino ni kitu gani ? _____
11. Je, unahisi unahitaji matibabu ya kiini cha mzizi wa jino kwa sasa?
    (ndiyo=1, hapana=2) [ ]
12. Kama *Ndiyo*, eleza ni kwa nini _____
13. Kama *Hapana*, eleza ni kwa nini _____