

JUNIOR RESIDENTS' AND SURGERY ASSISTANTS' KNOWLEDGE OF FOUR-HANDED DENTISTRY IN A NIGERIAN TEACHING HOSPITAL

Igweagu C.E.,¹ Alalade O.¹, Oguchi C O.,² Ikusika O F¹

¹Department of Restorative Dentistry, Bayero University Kano/Aminu Kano Teaching Hospital; Kano State.Nigeria

²Department of Child Dental Health, Bayero University Kano/Aminu Kano Teaching Hospital; Kano State.Nigeria

Corresponding author: Dr Oluwafeyisayo Francis IKUSIKA feyiikusika@yahoo.com
feyifrancisxavier@gmail.com.+2347039294927

ABSTRACT

INTRODUCTION: There is a paucity of studies on four-handed dentistry in Nigerian Teaching Hospitals. This protocol will be useful in the post-COVID-19 era. A situation analysis of the knowledge of a target population was conducted with a view to its introduction.

OBJECTIVE: Assessment of knowledge of junior residents and surgery assistants in thematic areas of Four-Handed Dentistry (FHD) and a comparison of both groups.

MATERIALS AND METHODS: A cross-sectional questionnaire-based survey to determine levels of knowledge in pre-operative communication, ergonomics, and prevention of cross-contamination related to FHD within the study cohort. Descriptive statistics were used to determine the levels of expertise in FHD among sub-populations. Sub-group comparisons were done. Statistical significance was set at $p < 0.05$

RESULTS: 22 residents and 9 assistants participated in the study. There was a 3.4:1 male: female ratio among residents. Assistants had almost equal gender representation. Residents were significantly older ($p=0.04$). Both groups had similar post qualification experience ($p=0.43$). Median scores in subthemes of FHD were: Pre-operative protocols: {Residents- 71.4%(46.7 – 71.4), DSA- 71.4%(57.1 – 71.4)}, Ergonomics: {Residents- 53.3%(46.7 – 60.0), DSA-40.0%(36.7 – 50.0)}, Cross infection control: {Residents- 71.4%(57.1 – 71.4), DSA- 71.4%(50.0 – 85.7)}.

CONCLUSION: Gaps in knowledge were displayed in all aspects of FHD. These gaps were more evident with ergonomics.

KEYWORDS: Four-handed dentistry, ergonomics, occupational health and safety, junior residents, surgery assistants

INTRODUCTION

The dental profession is not without occupational health hazards.^{1,2} These hazards include risks of musculoskeletal disorders and cross-infection risks. These two hazards have been extensively reported on in the local literature.³⁻⁷ The emergence of the novel Coronavirus (COVID 19), however, further reinforces the need for increased vigilance to prevent occupational hazards within the dental operator.⁸⁻¹⁰ The adoption of protocols that reduce the likelihood of hazards within the clinic have been shown to be effective in promoting occupational health and safety within the operator.¹¹

One of the protocols that have been proven to be effective in this regard is the practice of Four-Handed Dentistry (FHD).^{9,12} FHD may be described as a system of practicing dentistry where the dental surgeon and assistant work synergistically during operative procedures to maximize the efficiency of their actions. The use of space and transfer of instruments and materials is ergonomically performed, with the least risk of cross infection.^{13, 14} It requires that the surgeon and assistant are familiar with and discuss procedures beforehand.^{13, 14} Instruments and materials are arranged beforehand in a manner that would best ensure

efficiency.^{15,16} Most non-surgical aspects of treatment must be delegated to the assistants, and the space around the patient must be separated into zones.

The practice of FHD may be divided into three themes. These are pre-operative communication, ergonomics, and prevention of cross-contamination. These three themes of FHD may be divided into subthemes. Pre-operative communication will have as subthemes communication and role assignment between dentist and assistant; and instrument and equipment arrangement.⁹ Ergonomics will have the positioning of patients and care providers, non-verbal communication, motion economics, and zones' concept and usage.^{9,14} Cross infection control is concerned with instrument transfer and limitation of cross contamination.^{13,14}

The dental resident is important to introducing improvements in the practice of the profession in Nigeria.¹⁷ They represent the pool of future trainers. A protocol like FHD will define a cost-effective means of improving dental, occupational health, and safety in a developing country like Nigeria. The dental residents and surgery assistants could be the foundation for this development.

While many studies have been carried out to assess occupational hazards related to the dental profession in Nigeria³⁻⁷, few of these studies investigated possible protocols to remedy these hazards. An extensive search of the literature (Medline PubMed and Google Scholar did not return any Nigerian study examining knowledge of FHD.

This study was carried out to remedy this gap in knowledge and serve as baseline data on which FHD can be introduced in our teaching hospitals as a standard protocol.

MATERIALS AND METHODS

The study was a cross-sectional questionnaire-based observational study. It was conducted in the Dental Centre of the Aminu Kano Teaching Hospital in Kano State of Northwestern Nigeria. The study population comprising all junior dental resident doctors and surgery assistants working in the Dental Centre. Residents or DSAs who declined participation were to be excluded from the study. Ethical approval (NHREC/28/01/2020/AKTH/EC/2993) was obtained from the Ethics Review Board of The Aminu Kano Teaching Hospital Kano, Nigeria.

A 34-question questionnaire (Appendix A) was designed and pre-tested on a group of 4 senior residents and two trainee surgery assistants after content validation by all of the investigators. All participants in the pre-test accepted that the questionnaire was easy to understand. The questionnaire had four questions retrieving data on biometrics and occupational experience. There were 30 "true and false" questions testing knowledge in the three themes of FHD. Eight questions assessed knowledge of pre-operative protocols, 15 questions assessing knowledge of ergonomics and motion economics, and seven questions assessing knowledge of cross infection control. Correct responses attracted a score of 1, while wrong answers attracted a score of 0. Scores were to be recorded by simple proportion as percentages for each of the themes (including subthemes) of FHD tested. The scores for this part of the questionnaire were categorized as poor (less than 40%), fair (40 to 66.9%), and good (70% and above) Hard copies of questionnaires were placed in the residents' lounge by the chief resident for completion by all junior residents. The head Dental Surgery Assistant (DSA) acted similarly by placing questionnaires in the room for DSAs. Completed questionnaires were returned to designated spots in both rooms and retrieved after a 10-day waiting period from 8th March to 19th March 2021.

The data retrieved was entered into an electronic spreadsheet on a personal computer and analyzed with IBM SPSS Statistics version 23 for windows. Frequencies were recorded. Means and standard deviations were derived for biodata. Medians and interquartile ranges were determined for data obtained from the test of themes and subthemes of FHD. Sub-group comparisons were done using the Fisher's Exact

test and its non-parametric equivalent (Mann-Whitney and Friedman) as applicable.

RESULTS

A total of 31 consenting participants representing 100% of potential participants, were recruited into the study. The participants included 22 junior resident doctors and 9 DSAs. 17 (77.3%) of the resident doctors were male, while 5 (22.7%) were female. The DSAs had 5 (55.6%) males and 4 (44.4%) females within their ranks. The resident doctors were generally older than the DSAs ($p=0.04$). 4 residents were less than 30 years old, while 11 and 7 were between 31 and 35 years old; and older than 35 years old, respectively. Six DSAs were less than 30 years old, and two were between 31 and 35 years old. One DSA was older than 35 years old.

The differences in post qualification experience for both groups of participants were not statistically significant ($p=0.43$). Ten residents and 2 DSAs had between 1 and 5 years of post-qualification experience, while ten residents and 2 DSAs had between 6 – 10 years of such experience. Four residents and 1 DSA had over ten years of experience. The socio-demographic characteristics of the participants are illustrated in table 1.

Table 1. Demographic characteristics of study participants

Characteristics	n (%)			P
	Residents (n = 22)	DSA (n = 9)	Total (n = 31)	
Gender				0.39
Female	5 (22.7)	4 (44.7)	9 (29)	
Male	17 (77.3)	5 (55.6)	22 (71)	
Age (years)				0.04*
30 & below	4 (18.2)	6 (66.7)	10 (32.3)	
31 to 35	11 (50)	2 (22.2)	13 (41.9)	
> 35	7 (31.8)	1 (11.1)	8 (25.8)	
No of years post qualification				0.43
1 to 5	8 (36.4)	6 (66.7)	14 (45.2)	
6 to 10	10 (45.5)	2 (22.2)	12 (38.7)	
> 10	4 (18.2)	1 (11.1)	5 (16.1)	

P-value obtained using fisher's exact test

**Significant at $P < 0.05$*

Communication and role assignment had 3(13.6%), 7(31.8%), and 12(54.5%) of residents returning poor, fair, and good scores, respectively. The DSAs had 4(44.4%) and 5(55.6%) returning fair and good scores, respectively. Three (13.6%), 18(81.8%) and 1(4.5%) of resident doctors returned poor, fair, and good scores respectively with regards to the arrangement of instruments and equipment, while 1(11.1%), 7(77.8%) and 1(11.1%) of the DSAs returned poor, fair and good scores respectively.

Six (27.3%), 15(68.2%), and 1(4.5%) of residents had poor, fair, and good scores respectively regarding positioning of patient and care providers.

The DSAs returned 3(33.3%) and 6(66.7%) poor and fair scores. The residents had 6(27.3%), 14(63.6%), and 2(9.1%) poor, fair and good scores respectively in the area of non-verbal communication; while the DSAs had 4(44.4%), 4(44.4%) and 1(11.1%) poor, fair and good scores respectively in this area. Residents returned 6(27.3%), 12(54.5%) and 4(18.2%) performances respectively regarding motion economics; while the DSAs returned 3(33.3%), 5(55.6%) and 1(11.1%) poor, fair and good performances respectively. Concerning zones and their usage, residents returned 8(36.4%), 6(27.3%), and 8(36.4%) poor, fair, and good scores, respectively. The DSAs respectively returned 7(77.8%)

and 2(22.2%) poor and fair scores. None of the DSAs recorded a good score with regards to knowledge of zones and their usage.

The residents respectively returned 5(22.7%), 15(68.2%), and 2(9.1%) poor, fair and good scores concerning knowledge of instrument transfers; while DSAs recorded 1(11.1%), 7(77.8%), and 1(11.1%) respectively in this subtheme. The knowledge of prevention of cross-contamination using FHD returned 2(9.1%), 5(22.7%), and 15(68.2%) poor, fair, and good scores respectively among resident doctors and 2(22.2%) and 7(77.8%) poor and good scores among DSAs respectively. There were no fair scores among DSAs for this subtheme. The performances of both groups of respondents with regards to the themes and subthemes of FHD assessed are shown in Table 2.

Table 2. Distribution of knowledge of subthemes of FHD

Preoperative protocols	n (%)		
	Residents (n = 22)	DSA (n = 9)	Total (n = 31)
Communication and role assignment			
Poor	3 (13.6)	0	3 (9.7)
Fair	7 (31.8)	4 (44.4)	11 (35.5)
Good	12 (54.5)	5 (55.6)	17 (54.8)
Arrangement of instrument and equipment			
Poor	3 (13.6)	1 (11.1)	4 (12.9)
Fair	18 (81.8)	7 (77.8)	25 (80.6)
Good	1 (4.5)	1 (11.1)	2 (6.5)
Ergonomics			
Positioning			
Poor	6 (27.3)	3 (33.3)	9 (29)
Fair	15 (68.2)	6 (66.7)	21 (67.7)
Good	1 (4.5)	0	1 (3.2)
Non-verbal communication			
Poor	6 (27.3)	4 (44.4)	10 (32.3)
Fair	14 (63.6)	4 (44.4)	18 (58.1)
Good	2 (9.1)	1 (11.1)	3 (9.7)
Motion economics			
Poor	6 (27.3)	3 (33.3)	9 (29)
Fair	12 (54.5)	5 (55.6)	17 (54.8)
Good	4 (18.2)	1 (11.1)	5 (16.1)
Zones and their usage			
Poor	8 (36.4)	7 (77.8)	15 (48.4)
Fair	6 (27.3)	2 (22.2)	8 (25.8)
Good	8 (36.4)	0	8 (25.8)
Cross infection control			
Instrument transfer			
Poor	5 (22.7)	1 (11.1)	6 (19.4)
Fair	15 (68.2)	7 (77.8)	22 (71)
Good	2 (9.1)	1 (11.1)	3 (9.7)
Limitation of cross contamination			
Poor	2 (9.1)	2 (22.2)	4 (12.9)
Fair	5 (22.7)	0	5 (16.1)
Good	15 (68.2)	7 (77.8)	22 (71)

A comparison of the performance of both groups of participants does not show statistical significance with regards to pre-operative protocols. However, the performance for instrument arrangement was more unsatisfactory for both groups. There was statistical significance with the knowledge of zones and their usage ($p=0.02$). All other ergonomic parameters did not show any statistically significant differences between both groups. However, the understanding of positioning, non-verbal communication, and zones' knowledge was more deficient for both groups. While the knowledge of prevention of cross-contamination was fair to good for both groups, scores were lower for knowledge of instrument transfer. However, this did not attain statistical significance between the groups ($p=0.62$). The comparison of the performance of both groups is shown in Table 3.

Table 3. Comparison of knowledge of pre-operative protocols between dental residents and dental surgery assistants

Preoperative protocols	Percentage scores (%)		P-value (Mann-Whitney)
	Residents Median (IQR)	DSA Median (IQR)	
Communication and role assignment	75 (50 – 75)	75 (50 – 75)	0.73
Arrangement of instruments and equipment	50 (50 – 50)	50 (50 – 50)	0.61
Ergonomics			
Motion economics	66.7 (33.3 – 66.7)	66.7 (33.3 – 66.7)	0.54
Positioning	50.0 (33.3 – 66.7)	50.0 (33.3 – 50.0)	0.56
Non-verbal communication	50 (0 – 50)	50 (0 – 50)	0.69
Zones and their usage	50 (25 – 75)	25 (25 – 37)	0.02*
Cross infection control			
Instrument transfer	66.7 (58.3 – 66.7)	66.6 (66.7 – 66.7)	0.62
Limitation of cross	75 (60 – 75)	75 (50 – 87)	0.85

IQR: Interquartile range *Significant at $P < 0.05$

There was a statistically significant difference between the two groups of participants regarding their performance in the three subthemes tested. Both groups had the poorest performance in the ergonomics thematic area. Residents' performance in their knowledge of ergonomics ($p=0.001$) compared to other parameters was relatively unsatisfactory than that of DSAs ($p=0.004$). FHD. The performance of the DSAs with regards to the knowledge of zones was statistically more unsatisfactory than that of the residents ($p=0.02$). The difference in performance within and between groups in the three subthemes is illustrated in Table 4.

Table 4. Differences between and within groups in subthemes of FHD

Areas of FH dentistry	Percentage scores (%)		P-value (Mann-Whitney)
	Residents Median (IQR)	DSA Median (IQR)	
Preoperative protocols	71.4 (53.6 – 71.4)	71.4 (57.1 – 71.4)	0.45
Ergonomics	53.3 (46.7 – 60.0)	40 (36.7 – 50.0)	0.02*
Cross infection control	71.4 (57.1 – 71.4)	71.4 (50.0 – 85.7)	0.78
P-value (Friedman test)	< 0.001*		0.004*

*IQR: Interquartile range *Significant at $P < 0.05$

DISCUSSION

Planning in oral healthcare delivery usually starts from an analysis of current situations.¹⁷⁻²⁰ The emergence of new challenges usually mandates a situational analysis to ensure the effectiveness of selected strategies.²¹ The post-COVID-19 pandemic era has been described as an epoch that would define a new normal in healthcare delivery.²² The Dental profession cannot afford to be left behind in these developments. There is a growing realization that infection control protocols must improve at this time.^{22,23}

Previous studies have compared the knowledge base of dentists and surgery assistants with regard to infection control practices.²⁴⁻²⁶ There have been studies comparing the incidence of the effects of poor ergonomic practices in both cohorts.^{4,27} There have also been studies comparing their reactions to the emergence of the COVID-19 pandemic.²⁸ However, we did not find any studies comparing their knowledge of the practice of FHD.

Four-handed dentistry has been shown to improve the efficiency of dental procedures.^{15,16} It is, however, a technique that requires training and regular practice to master.²⁹ The components of this technique ideally should seamlessly blend into each other if the aims of the technique are to be achieved.¹³⁻¹⁶ Gaps in knowledge and practice, no matter how minute, may render the technique ineffective.¹³⁻¹⁶

The resident doctors were generally older and had more years of post-qualification experience than the DSAs. This is not surprising considering that they require a longer training time and have to pass strenuous examinations before they are admitted into the residency programs. However, we have not related age and work experience with knowledge of FHD in this study. In our considered opinion, we have considered this superfluous to our aim. We aimed to assess the current situation at our center as part of a plan to institute a training protocol in FHD.

The male residents outnumbered their female counterparts by a ratio of 3.4:1, while the gender mix among DSAs was almost equal.

This is not surprising in a male-dominated, patriarchal society like Northern Nigeria.

Professional occupations are mostly seen as the preserve of men, while women are viewed mainly as homemakers.^{30,31} While there is growing evidence that this worldview is gradually receding from the mainstream, the results of this study remind us of the need for increased advocacy for women empowerment in our communities.

The skewed nature of the results obtained suggests that the participants made their judgments from some form of inherent repository of information. This repository could be some formal training, or on-the-job experience gathered over the years. However, the results obtained in this study do not suggest that they have had any formal training in FHD.

The residents had greater knowledge of communication and role assignment than the DSAs. Both groups of participants, however, had a very mediocre knowledge of instrument/equipment arrangement. By virtue of their higher-level training and more significant on-the-job experience, the residents are expected to be more knowledgeable than the DSAs. The greater knowledge in communication and role assignment is therefore not surprising. The poor performance regarding instrument/equipment arrangement may be due to prevailing practice within the institution. The institution practices barrier methods of cross-infection control along with the use of pre-packed instrument cassettes. This contrasts with the requirements for FHD, where instruments are arranged on a need basis for each case.

The performance of both groups of participants in the four subthemes under ergonomics was generally very mediocre. There was no significant difference among both groups except in the area of zones and their usage. The DSAs had a worse performance here, even though the residents were also mediocre. This further reinforces the observation that there is a lack of formal training in FHD. The concept of zones is peculiar to FHD, and the performance in this field would be indicative of training particular to FHD.¹⁴⁻¹⁷ The greater comfort and efficiency that would result from improving ergonomics with the practice of FHD may increase the level of 'buy-in' into the program if it is introduced.

The process of instrument transfer in FHD is organized so that the assistant does not come in contact with instruments after being contaminated by the patient's mouth.¹⁶ The participants performed at a lower level regarding instrument transfer than they did with prevention of cross-contamination, where they performed quite well. This suggests the participants have a fair idea of cross-infection control, but this knowledge is not specifically related to FHD.

The participants performed significantly poorly with regards to ergonomics within and between groups. This suggests that they grossly lacked knowledge of the ergonomic aspects of FHD. This area should have large amounts of attention assigned to it when training individuals in FHD. The training of the DSA is essential

with regards to FHD and should be integrated into any training programs developed for such a purpose.

This study is limited by the relatively small number of participants and its location within only one institution. More extensive multi-center studies recruiting more cadre of dentist is advocated for a clearer picture of the situation nationally.

CONCLUSION

FHD is a desirable protocol to institute in our teaching hospitals. A situational analysis of resident doctors and DSAs at our center revealed gaps in the knowledge of junior resident doctors and DSAs concerning the practice of FHD. The knowledge of ergonomic was limited within both groups studied. The DSAs had unsatisfactory performances in this area than the resident doctors.

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