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## Assessing cross infection prevention measures at the Dental Clinic, University College Hospital, Ibadan

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### Summary

The dental clinic is an environment where disease transmission occurs easily. Prevention of cross infection in the dental clinic is therefore a crucial aspect of dental practice and dental clinic workers must adopt certain basic routines while practising. This study evaluates basic routines in prevention of cross-infection in the dental clinic, University College Hospital Ibadan. The sample comprised 77 dental clinic workers, who completed closed-ended questionnaires. The questionnaires enquired into practices of the workers in the clinic as well as in the laboratories. Physical inspection of dental equipment, instruments and materials was also carried out. The results highlight poor compliance of workers, especially the dental surgeons and students, with the hepatitis B vaccination programme of the Hospital. History to identify high risk individuals was often overlooked and was practised by less than 50% of the clinic workers. Barrier technique with the exception of the use of eye shield, was well practised by all the clinic workers. Aseptic technique was well practised in the dental clinic. Inadequate number of dental surgery assistants, faulty sterilizing equipment, poor monitoring of sterilization, coupled with inadequate number of instruments contributed to the poor success of prevention of contamination and instrument processing procedures. Less than 30% of dental surgeons and fewer than 50% of students discarded sharp materials into the yellow/sharp bin. Liquid waste was well disposed off through the drain for onward flow into the sewer, whilst the disposal of solid contaminated waste did not conform to stipulated international standard. The study found that successful infection control in the dental clinic was highly dependent on the dental surgery assistants, because highly technological equipment were lacking. The management/administration also plays an important role in the number of physical and human resources available and in the overall surveillance of nosocomial infections.

**Keywords:** cross infection, sterilization, disinfection. Infectious waste.

### Résumé

La clinique dentaire est un environnement où la transmission des maladies a lieu facilement. La prévention des infections croisées dans cette clinique est alors un aspect crucial de la pratique dentaire et le personnel dentiste doit adopter certaines routines de base lors des pratiques. Cette étude évalue ces bases journalières de la prévention des infections croisées dans la clinique dentaire du Collège Hospitalier Universitaire d'Ibadan. L'échantillon comprenait 77 travailleurs de cette clinique qui ont rempli un questionnaire qui cherchait à mieux comprendre les pratiques journalières de les travailleurs dans la clinique aussi bien que dans les laboratoires. L'inspection des équipements, instruments et du matériel a été faite les résultats montrent une faible conformité des travailleurs

spécialement les chirurgiens dentaires et les étudiants du programme de vaccination contre l'hépatite B de l'hôpital. L'historique pour identifier les individus à haut risque était très souvent négligé et était pratiqué par moins de 50% des travailleurs. Les techniques de barrière avec l'exception de l'usage de l'écran des yeux étaient bien pratiquées par tout le personnel de la clinique. L'asepsie était bien prise en considération dans cet environnement. Le nombre inadéquat des assistants chirurgiens dentaires, l'équipement de stérilisation défectueux, mauvais contrôle de la stérilisation. Ajouté à un nombre des instruments inadéquats contribuent à un pauvre succès de la prévention de la contamination et les procédures de traitement des instruments. Moins de 30% des chirurgiens et à peu près 50% des étudiants jetaient les matériaux aiguisés dans la poubelle jaune. Les déchets liquides étaient bien disposés à travers le canal qui conduit à l'égout, alors que l'évacuation des déchets solides contaminés ne se conformait pas à la stipulation mondiale des standards. L'étude a trouvé le contrôle de l'infection avec succès à la clinique dentaire dépendait largement des chirurgiens assistants, parce que les équipements de haute technologie manquaient. L'administration joue aussi un rôle important dans la quantité des ressources physiques et humaines disponibles, et la surveillance globale des infections nosocomiales.

### Introduction

The effective control of cross-infection in the clinic constitutes a significant factor in the prevention of nosocomial infections [1]. Nosocomial infections are those infections that develop during hospitalization or patient care and are neither present nor incubating at the time of admission or treatment of the patient [1]. The most frequently reported pathogens by site include *Escherichia coli* for urinary tract infections (UTI), *Staphylococcus aureus* for surgical wound infections (SWI), *Pseudomonas aeruginosa* for pneumonia and coagulase-negative Staphylococci for blood stream infections (BSI) [1]. Apart from intrinsic factors such as age, sex, underlying diseases and immune status, extrinsic risk factors, including surgical procedures, diagnostic and therapeutic interventions and personnel exposures, play a dominant role in predisposing patients to nosocomial infections [1].

Procedures in dentistry, ranging from simple polishing of restorations to complex and extensive surgery of the bone and soft oro-facial tissues, predispose dental personnel and patients to nosocomial infections [2]. The close proximity of dental health personnel to patients during treatment as well as the nature of the oral cavity environment put them particularly at risk [2]. Prevention of nosocomial infection rely on patient care practices. It also involves reducing the dose of microorganisms that might be shared between patients and the dental team through immunization against specific diseases [3]. Thus practices which involve prevention of cross-infection in the dental clinic have been categorized into proper instrument processing, surface and equipment disinfection, barrier technique, other aseptic techniques, waste disposal, immunization and laboratory asepsis [3]. It is the aim of this study to evaluate practices involving prevention of cross-infection in the dental clinic, University College Hospital, Ibadan, according to the above principles.

### Materials and methods

The study was conducted on 77 dental clinic workers at the



University College Hospital Ibadan, in year 2000. The study group included dental surgeons, dental surgery assistants, therapists, dental technologists, pathology laboratory technologist/assistants, nurses and cleaners. The record clerks, who do not come in direct contact with patient's blood, tissues, or secretions, were excluded from the study. It was presumed that their contamination was dependent on the dental clinic workers and they will be indirectly protected if cross infection prevention practices are adhered to in the clinic. All workers of the above-mentioned cadre were included in the study. Questionnaires, containing coded questions investigating practices of clinic workers in the prevention of cross infection in the dental clinic, was designed and distributed to each cadre of workers. The questionnaires enquired into practices of workers, in taking history, in prevention of contamination, sterilization procedures, disinfection procedures and waste disposal methods in the clinic. A student interpreted and interviewed respondents who were not conversant with English language whilst other participants completed the questionnaire themselves.

The authors physically inspected available instrument, equipment and materials, which could promote prevention of cross-infection in the dental clinic, such as autoclaves, eye shields, saliva ejectors, hand pieces, dental chairs, aprons (bibs), plastic cups, chitel forceps, suction machine, rubber dams and yellow/rigid bins.

#### Method of analysis

Although various options were present for each question, practices conducive to prevention of cross infection were derived during analyses of the data. One-off-habits, answers as sometimes, were regarded as not good enough in prevention of cross-infection. Collation and verification of the data done daily until all questionnaires were collected. Analysis of the data was done manually. The frequency distribution percentage frequency of the variables were determined and expressed in the form of tables and bar charts.

Figure 1 shows the utilization of barrier technique by the different groups of workers. There was an obvious difference between the use of gloves 33(100%) and face mask 23(69%), among dental surgeons and their assistants. Only 26.1% of dental surgeons and 33% of dental technologist claimed to use eye shields when treating a patient or using the high-speed equipment Fig 1. In addition 87% of dental surgeons, 75.9% of students practised zoning, (restricting working area to a specific place. A low percentage (39.1%) of dental surgeons, 44.8% of students and 40% of dental auxiliaries avoided operating the dental equipment with gloved hands. Only 39.1% of dental surgeons claimed they are effectively assisted by dental surgery assistants when treating a patient.

Table 2 elucidates practices of clinic workers in the use of sterilized materials and instruments. This table demonstrates that aseptic technique are well incorporated into the working habits of clinic workers. Hundred percent of workers use fresh sterile gloves, as well as fresh sterile needles and 98% fresh sterile instruments and fresh cartridges for each patient.

Only the dental surgery assistants were interviewed on sterilization procedures in the clinic, since they were directly responsible for these procedures. A high percentage (100%) of them claimed they autoclaved the instruments for at least one hour or more. Similarly 62.5% of them claimed they autoclaved the instruments after 24 hours if not used. All the dental surgery assistants claimed they picked all instruments using the chitel forceps. Disinfection of instruments before they were sterilized was practised by none of the dental assistants, rather, the instruments were washed with detergent and then sterilized. Only 37.5% of them claimed they disinfected the sputum bowl after the treatment of each patient, although at the end of each day the cleaners washed the sputum bowl with Vim and detergent. Seventy-five per cent of the dental surgery assistants claimed they disinfected the working surfaces and the bibs after treatment of each patient. They also claimed they disinfected the hand pieces by wiping them with spirit. All the cleaners

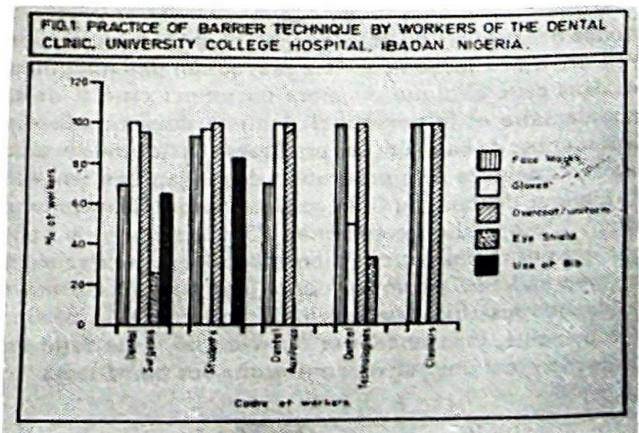
Table 1: Compliance of personnel of dental clinic, University College Hospital, to hepatitis B vaccination.

Category	Dental Surgeons (23)	Students (28)	Auxiliaries (10)	Tech. (6)	Cleaner (4)	Total 71
Vaccinated	(4) 17.4%	(0) 0%	(7) 70%	(2) 33.3%	(0) 0%	(13) 18.3%
Not vaccinated	(19) 82.6%	(28) 100%	(3) 30%	(4) 66.7%	(4) 66.7%	(58) 81.7%

respondents consisted of 38 (49.4%) females and 39(50.6%) males. It included 23 (29.87%) dental surgeons, 29(37.66%) dental surgery assistants, 8 (10.39%) dental surgery assistants, 2 (2.60%) denturists, 8 (10.39%) technologist/assistants, 3 (3.90%) midwives and 4 (5.19%) cleaners. A student and 2 nurses/therapists who did not submit their questionnaire, a pathology laboratory technologist, a dental technologist and the headmaster were on leave were excluded from the study.

Table 1 illustrates the percentage frequency of work-ous cadres vaccinated against Hepatitis B virus (HBV). It demonstrates a higher compliance of the auxiliaries (70%) to hepatitis B vaccination.

This study revealed that 56.5% of dental surgeons, 26.1% of dental students and 50% of therapists in this clinic did not identify high-risk individuals when taking the history of





claimed they mop the floor at the end of the day's work with a disinfectant, which are products of phenol compounds such as morriagad (Dichloroxylenol + chlorophenol) and Izal (chlorophenol). Impression materials or dentures sent to the laboratory were not disinfected before being sent.

Only 26.1% of dental surgeons and 42.9% of students discarded sharp objects into the rigid or sharp bin. All workers discarded tissues and soiled materials from patients into the waste paper baskets provided in the clinic.

**Table 2:** Practice of aseptic technique by operating clinic workers of the dental clinic, University College Hospital, Ibadan.

Sterilized item	Dental surgeons (23)	Students (28)	Dental therapist (2)
Fresh sterile gloves for each patient	(23) 100%	(28) 100%	(2) 100%
Fresh sterile needle for each patient	(23) 100%	(28) 100%	-
Fresh sterilized instruments for each patient	(22) 95.7%	(28) 100%	(2) 100%
Fresh cartridges for each patient	(22) 95.7%	(28) 100%	-

Observations made during physical inspection included acute shortage of instruments and materials such as rubber dam, saliva ejectors, instruments for oral surgery, periodontal, paedodontic, restorative and orthodontic procedures, inadequate number of appropriate equipment, inadequate number of dental assistants, and 31(91.2%) out of 34 dental chairs were hand operated with buttons near the head rest. However, materials for barrier technique, except for eye shield were readily available. After physical examination of the facilities available and interview of the dental assistants, it was confirmed that the temperature gauge, pressure gauge and timer of the autoclave were not functioning. Therefore, the autoclave could not be set at a specific temperature, pressure and time. Monitoring materials were also not available to them. Liquid waste was disposed off through the sputum bowl and the drain for onward flow into the sewer.

## Discussion

In developing countries lack of appropriate physical and human resources contribute to the inability to apply effective cross-infection control procedures [4].

The risk of exposure to blood borne pathogens such as Hepatitis B and human immunodeficiency viruses for all health care workers has been long recognized by various authorities [5,6,7]. Cross-contamination from a member of the dental team to a patient is relatively rare, however, there have been documented case reports of such infections as Hepatitis B and human immunodeficiency viruses [8,9]. Hepatitis B (HBV) and herpetic whitlow are occupational hazards of the dental profession [10] and various studies have documented incidence rates of HBV among unvaccinated individual dental clinic personnel to be 3 to 10 times the 4% rate present in the general population [11]. Dental clinic personnel are also exposed to tetanus and other communicable diseases amongst which are

tuberculosis, influenza, pneumococcal pneumonia, measles, rubella, mumps and poliomyelitis [10].

This study highlights the alarming percentage (81.7%) of dental clinic personnel, especially the dental surgeons and students, who though were constantly in contact with blood, secretions or oral tissues were not vaccinated against HBV infection. The difference between the compliance of auxiliaries and other workers may stem from the strict discipline within the nursing administrative structure, which supervises auxiliaries. Recently the management of the University College Hospital screened all its workers and offered them a full course of Hepatitis B vaccine at no cost. This is a highly commendable effort. Unfortunately the same personnel, especially the very workers who are knowledgeable of the effect of this deadly disease, remain unvaccinated. Various studies on the compliance of hospital workers in other countries have demonstrated poor compliance of hospital workers [12] whilst others have shown moderate compliance from hospital workers and a high compliance amongst the dentists in the United States of America [13].

Less than 50% of the dental surgeons and students take comprehensive history with the aim of identifying high risk individuals. In view of the recent epidemiological information on AIDS and HIV in Nigeria [15], the chances of coming across HIV positive or AIDS patients in the dental clinic is on the increase. Therefore it is possible that some high risk individuals might have not been identified and the necessary high risk strategy to prevent cross-infection not applied, thus exposing other personnel and patients to cross-contamination. Observations from some studies have demonstrated a great disparity between the infection rates of HBV in Africa as well as Asia and South America (60% to 90%) and the infection rates of HBV in North America and Northern Europe (7% - 12%) [14]. With the new trend of HIV infection in Nigeria (prevalence rate of 3.5% - 7%) [15], there is a pressing need to identify high risk individuals.

The personnel seem to have a good knowledge of positive attitude and behaviour towards prevention of contamination. Materials, encouraging the practice of barrier technique except the eye shield were readily available to the dental personnel. Transmission of HBV infection through the cornea has been well documented [2]. The use of face mask did not enjoy as much concern as the use of overcoat and gloves by dental surgeons and their dental assistants. This suggest complacency towards cross-infection, which could occur via the nasal mucosa. The high compliance of laboratory technologists with the use of face mask is probably associated with the anxiety about and awareness of other occupational hazards which they may be exposed to during laboratory procedures. However, some lapses were observed in aspects of prevention of contamination, attributable to factors beyond the control of clinic staff. Whilst modern equipment requiring infrequent use of the hands and fingers are necessary to achieve the objective of prevention of contamination, the role of dental surgery assistants in achieving this objective cannot be over emphasized. Every operating personnel should be assisted by a dental surgery assistant.

Aseptic technique, practices involving the use of sterilized materials and instruments were found to be well incorporated into the working habits of dental clinic personnel. The aim of instrument recirculation process is to prevent transfer of infectious agents to patients from contaminated instruments and at the same time to protect the staff who might handle these instruments [15]. The stages of instrument processing, pre-soaking in detergent disinfectant, cleaning, packaging, sterilization,



monitoring and distribution [16] were not strictly adhered to in the study group. Similarly, the true state of sterilization of instruments in this clinic could not be ascertained neither was any form of regular monitoring practiced. The inability to successfully adhere to prevention measures was multifactorial. Lack of adequate number of instruments resulting in instruments being hurriedly recycled, lack of monitoring materials, poorly maintained and malfunctioning sterilizing equipment and lack of awareness of the inherent danger posed by such inadequacies, constituted some of the deterring factors.

Disinfection complements other procedures already discussed in the prevention of nosocomial infection and no procedure can be practised in isolation. The effective use of disinfectants constitutes a significant factor in the prevention of nosocomial infections especially those that would otherwise be transmitted through direct and indirect contacts with working surfaces. Studies have demonstrated the survival of HBV for up to 10 days in dry environments on inanimate surface [17]. Further studies demonstrated the presence of Hepatitis B surface antigen (HBAG) on a variety of laboratory surfaces, dental surgery surfaces, hemodialysis units, etc., where there is frequent contamination with blood or tissue fluid even in the absence of visible blood or chemically detectable blood [18]. Studies measuring the spread of aerosol demonstrated the spread of aerosol and bacterial contamination within a distance range of 42 C.F.U M3 even as far as areas where there were no dental activity [19]. Thus regular disinfection of surfaces after the treatment of each patient can not be ignored.

The disinfectant most commonly used in this dental clinic for disinfection of environmental surfaces is JIK, a household bleach and a chlorine product with intermediate level of activity. It is active against tubercle bacillus, vegetative cells, fungi and many viruses including HBV and HIV if used in the required aqueous concentrations (0.05 - 0.5% free chlorine) [18].

Wiping with alcohol is not sufficient to achieve adequate disinfection of hand pieces since alcohol is inactivated by the presence of organic materials such as saliva and blood. Alcohol is not sporicidal and it evaporates quickly rendering its antimicrobial effect brief [20]. Glutaraldehyde products such as Cidex are best suited for this purpose when the instrument or equipment part is soaked in it for at least one hour [20].

Any item which has been used in the oral cavity or on appliances or impressions is a potential source of infection [6]. Polishing procedures expose the operator to potential cross-infection and physical injury [6]. Therefore, all polishing agents should be obtained in small quantities and left overs discarded [6]. Laboratory infection control also involves the routine wearing of gloves, protective eyewear and when necessary masks [6]. The findings from this study indicate poor laboratory asepsis, implying that workers in the laboratory of the dental clinic are potentially exposed to cross-infection in the course of their duty.

Disposal of any form of waste, contaminated, medical or infectious waste whether solid or in liquid form is of great concern to the environmentalist. Disposal of liquid waste in the clinic was systemic well organized and conformed to standard regulations [7]. However solid waste such as soiled cotton wool, gauze and tissues discarded into waste paper basket without being sealed in polythene bags according to standard regulations [7], exposes other dental clinic workers such as the cleaners to potential contamination. Proper disposal of sharp materials such as needles, scapel blade, catridges has not been

quite successful. Even though sharp bins were provided, they were not readily accessible to operating staff as only one yellow/sharp bin was provided for each clinic of ten cubicles. In the absence of adequate assistance from dental surgery assistants, the alternative would have been to provide a sharp or yellow bin for each cubicle where the patients are treated.

### Conclusion

In spite of proven occupational risk and provision of safe and effective vaccines at no cost, the compliance of workers in the dental clinic to the Hepatitis B vaccination programme, initiated by the University College Hospital, was very poor. History taking with the view of identifying high risk individuals was overlooked by clinic workers, therefore high risk patients might have been missed and the high risk approach to the prevention of cross infection overlooked. The use of barrier technique, except the use of eye shield was well accepted and practised in this dental clinic. Aseptic technique was well accepted and practised in the study area. The success of prevention of cross-contamination in the dental clinic was highly dependent on the dental surgery assistants especially in situations where highly technological equipment were absent. The practice of four handed dentistry and prevention of contamination has not been successful in this clinic. Faulty sterilization equipment, poor monitoring, coupled with inadequate number of instruments have contributed to the inability to achieve success in this area of prevention of cross-infection. Adherence to correct disinfection procedures needs to be enforced whilst the disinfection of hand pieces needs to be improved on and sterilizable hand pieces purchased. Prevention of cross-infection in the dental laboratories needs more attention. Procedures used in the prevention of cross infection from solid waste was inadequate.

### Recommendation

The hospital management needs to employ more dental assistants. There is the need to train dental assistants along with the training of the students and residents to enable them to get used to the practice of four handed dentistry and the prevention of contamination. It may be necessary to organize a training session on the prevention of cross infection for members of staff. The regular supply of barrier materials should be extended to the laboratory staff. There is much need for management to provide eye shields in the clinics and in the laboratories. More dental instruments and modern appropriate equipment such as sterilizers, dental chairs, etc, to facilitate instrument processing and management, as well as the prevention of contamination are required. Hepatitis B vaccination should be enforced on staff and students. Patients should be made to fill surveillance forms on infectious diseases. Disinfection of materials used on patients, such as impressions and appliances, before they are sent to the laboratories should be mandatory. Infectious disease control committees should be established to control nosocomial infections in the hospital. This should comprise of members of staff of different departments of the hospital.

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