**Original Article**

**Evaluation of Surgical Glove Perforation and Sharps Injury in Oral and Maxillofacial Surgery**

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**Abstract**

**Introduction:** The risk of exposure to infections during surgery is partly mitigated by gloving. However, perforation can reduce the effectiveness of gloving as a barrier to exposure. This study aimed at investigating the frequency of surgical glove perforation and factors predictive of these in our oral and maxillofacial surgical practice. **Materials and Methods:** The study was carried out at the National Hospital and the University of Abuja Teaching Hospital, Abuja, Nigeria. Consenting patients requiring oral surgical interventions were consecutively recruited into the study. Similarly, surgeons and their assistants who consented to the study were also enlisted in the study. At the end of every surgical procedure, gloves used by the surgeons and the assistants were tested for perforation. Variables investigated included the rate of perforations, the influence of the type of gloving, single versus double gloving, type of anaesthesia, and duration of surgery on rates. **Results:** At a minimum of three operators per procedure, a total of 154 participants were involved in the study and 895 gloves were used. The number of glove perforations was 117(13.1%) with 82 (70.1%) involving the surgeons. There were 58/117 (49.6%) cases of perforation involving the dominant hand. Forefinger glove perforation accounted for 62 (52.9%) cases. Wire-related perforations were 72 (61.5%). Overall, nine cases of percutaneous injury were recorded. Duration of operation and double gloving were the predictive factors for perforations. **Conclusion:** Risk of sharps injury was relatively high due to the high incidence of glove perforation.

**Keywords:** *Glove perforation, oral maxillofacial surgery, sharps injury*

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# Introduction

A sharp injury (SI) is defined as “parenteral introduction into the body of a health-care worker, during the performance of his duties, of blood or other potentially infectious material by a hollow-bore needle or sharp instrument, including but not limited to needles, lancets, scalpels and contaminated broken glass.”[1] Although gloves can be used to mitigate the risks associated with SI, they are often damaged during the course of a procedure and damage may not always be readily apparent, thereby placing the surgeon and patient at risk of infection. Determining the risk factors for glove perforation in the specialty and the relative risk associated with a specific procedure amongst other variables can aid the surgeon in deciding when a glove change is advisable.[2] Oral and maxillofacial surgery, with regular use of wires, needles, power drills and saws, is one of the surgical specialties that is likely to predispose

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practitioners to glove perforation and sharps injury. Previous reports confirm this to be the case,[3,4] although rates could differ, based on the environment of practice and the specific surgical procedure. The scope and pattern of surgical glove perforation in oral surgery has not been investigated in our practice; a limited-resourced environment, where the use of wires, arch bar and similar items, which have been replaced in other parts of the world are still in high use. Therefore, this study was carried out to determine the rates of glove perforation associated with wire and non-wire-related procedures and the factors associated with perforation. This could serve as a way of estimating the risk of sharps-related injuries and possible infection exposure hazard in oral and maxillofacial surgery.

# Materials and Methods

This cross-sectional study was conducted at the National Hospital and University of Abuja Teaching Hospital, Abuja. The participants were consecutive consenting

**How to cite this article:** Osodin TE, Akadiri OA, Akinmoladun VI. Evaluation of surgical glove perforation and sharps injury in oral and maxillofacial surgery. J West Afr Coll Surg 2022;12:1-5.

**Received:** 20-Apr-2022 **Accepted:** 11-Oct-2022 **Published:** 23 -Nov-2022

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| **Website:**[www.jwacs-jcoac.com](http://www.jwacs-jcoac.com/) |
| **DOI:** 10.4103/jwas.jwas\_98\_22 |
| **Quick Response Code:** |

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individuals who presented for oral and maxillofacial surgery in the two hospitals, the managing consultants, senior residents, and attending nurses. Surgical glove perforation among surgeons and their assistants during wire-based procedures such as fracture fixation and non-wire-based procedures, like, third molar surgery and biopsies were determined. Surgical gloves (Neogloves) manufactured by Neomedic Limited, were used in the study. Rate of perforations due to manufacturing or storage errors was determined by randomly selecting 5% of the gloves used for the study for pretesting. All glove testing was done using Water Inflation Technique and Electro-conductivity tests.[5] In addition, the Hosmer and Lemeshow goodness of fit tests were carried out to determine the fitness of the model for the study.

Simple descriptive analysis of surgical variables and demographic information using appropriate tools was carried out. All data processing was executed using the Statistical Package for Social Sciences (SPSS) version

20.0. The confidence level was set at 95% and a value was considered statistically significant when *P* < 0.05.

# Results

In this study, a total of 895 gloves were used, of which 564 were in wire-based procedures and 331 utilised for non-wire-

based procedures. In the wire-based group, surgeons used 337 gloves, whereas assistants used 227 gloves, while in the non-wire-based group, 173 and 158 gloves were utilised by surgeons and assistants, respectively. The number of glove perforations was 117(13.1%) with 82 (70.1%) involving the surgeon. Wire-related perforations were 72/117 (61.5%). Overall, there were 58/117(49.6%) cases of perforation involving the dominant hand [Table 1]. Forefinger glove perforation was reported in 62 (52.9%) cases. Also, for the dominant hand, the forefinger was the most frequently affected by perforations among both surgeons and their assistants in both wire and non-wire-based groups [Table 2]. In both wire-based and non-wire-based groups, double gloving and duration of surgery were risk factors for glove perforation; double gloving accounted for 81 (69.2%) of cases of perforation, surgeons who were double gloved accounted for 55(66.7%) cases [Table 3]. The risk of perforation was also associated with duration of surgery. Operation duration equalling or more than 61 min (odds ratio 4.9; 95% confidence interval [CI]) was significantly associated with glove perforation [Table 4]. Considering the total number of glove perforations encountered during wire-based procedures in this study, the probability of percutaneous injury, affecting either the surgeon or assistant, was estimated to be 8.4%. The surgeon had a higher probability (9.7%) of being affected.

## Table 1: Analysis of glove utilisation and perforations

**Surgeon Operating personnel assistant**

**Surgeon Assistant Total**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **wire** |  |  |  | **Nonwire** |  |
| Number of gloves used | 337 |  | 227 |  | 173 |  | 158 | 895 |
| Number of perforated gloves | 72 |  | 35 |  | 10 |  | 0 | 117 |
| Gloved hand with perforation |  |  |  |  |  |  |  |  |
| Dominant | 34 |  | 17 |  | 7 |  | – | 58 |
| Nondominant | 38 |  | 18 |  | 3 |  | – | 59 |

## Table 2: Analysis of glove perforations according to fingers affected during procedures

**Variables Working hand Total *n* (%)**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **T *n* (%)** | **F *n* (%)** | **M *n* (%) R *n* (%)** | **L *n* (%)** | **O *n* (%)** |  |
| Surgeon | 9(26.5) | 18(52.9) | 2(5.9) 0(0.0) | 0(0.0) | 5(14.7) | 34(100.0) |
| Assistant | 1(5.9) | 9(52.9) | 5(29.4) 0(0.0) | 0(0.0) | 2(11.8) | 17(100.0) |
|  |  |  | **Nonworking hand** |  |  |  |
|  | **T** | **F** | **M R** | **L** | **O** |  |
| Surgeon | 4(10.4) | 22(57.9) | 5(13.2) 1(2.6) | 0(0.0) | 6(15.8) | 38(100.0) |
| Assistant | 1(5.6) | 13(72.2) | 2(11.1) 0(0.0) | 0(0.0) | 2(11.1) | 18(100.0) |

T = thumb, F = forefinger, M = middle finger, R = ring finger, L = little finger, O = other parts of the hand

## Table 3: Glove perforations and percutaneous injuries in relation to method of gloving by operating personnel

|  |  |  |  |
| --- | --- | --- | --- |
| **Method of gloving** |  | **Glove perforations** |  |
|  | **Surgeon*****n* (%)** | **Assistant*****n* (%)** | **Total*****n* (%)** |
| Single gloving | 27(33.3) | 9(25.7) | 36(30.8) |
| Double gloving | 55(66.7) | 26(74.3) | 81(69.2) |
| Total | 82(100.0) | 35(100.0) | 117(100.0) |

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