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KNOWLEDGE OF SUPERINFECTION IN HIV INDIVIDUALS AMONG DENTAL STUDENTS AND PRACTITIONERS

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ABSTRACT:
INTRODUCTION:
Superinfection is highly relevant to the disciplines of public health and immunology because it indicates that primary infection may provide only limited cross-immunity against re-exposure to a new strain of the virus. Development of a prophylactic vaccine may be more challenging if superinfection with a particular virus is common.HIVsuperinfection occurs when an HIV-infected individual becomes re-infected with a new phylogenetically distinct viral HIV strain.
AIM: Aim of the study is to assess the knowledge of superinfection in HIV individuals among dental students and dental practitioners.
MATERIALS AND METHODS: A cross sectional questionnaire was designed and distributed to 105 dental students and practitioners. Questionnaire includes email address, year of study, and questions about knowledge of superinfection in HIV individuals and various methods of detecting superinfection in HIV individuals. Data was collected, statistically analysed and results were obtained.
RESULTS: Among the study population, majority of the study population (91.4%) aware that superinfection can occur in HIV individuals, whereas 7.6% of the study population not sure about the superinfection and 1.9% of the study population not aware of superinfection that occur in HIV individuals.
CONCLUSION: Most of the dental students and dental practitioners (91.4%) were aware of superinfection in HIV individuals. The results observed in our study showed that most of the dental students (third year, final year, intern) aware about dual infection, types of dual infection, difference between superinfection and coinfection and various diagnostic assays for superinfection in HIV individuals.

KEYWORDS: Superinfection, Human immunodeficiency virus, Dual infection, Bulk sequencing, Multi region hybridisation assays.

1. INTRODUCTION:

Superinfection is highly relevant to the disciplines of public health and immunology because it indicates that primary infection may provide only limited cross-immunity against re-exposure to a new strain of the virus. Development of a prophylactic vaccine may be more challenging if superinfection with a particular virus is common.Superinfection has been observed for many common viruses including human immunodeficiency virus (HIV), hepatitis C, herpes simplex virus (HSV) and cytomegalovirus (CMV) (1-4).HIV

superinfection occurs when an HIV-infected individual becomes re-infected with a new phylogenetically distinct viral HIV strain. The possibility of HIV-SI was first demonstrated by the observation of co-infection of both HIV-1 and HIV-2, which are evolutionarily distinct viral species, but share approximately 42% of nucleotide homology in their envelope genes (5-7). Additional suggestions of HIV-SI came from HIV-1 recombinant forms, which are HIV virions that contain separate genomic sections from distinct HIV-1 subtypes. HIV-1 is differentiated by genetic sequence into nine HIV-1 subtypes (A, B, C, D, F, G, H, J, and K). The subtypes are associated with different rates of disease progression, viral load, detection method assay sensitivity, and distinct geographic regions (8,9). HIV-1 virions are diploid and viral strains are able to recombine when two distinct subtypes infect a single cell. If this new recombinant strain is transmitted it can become a circulating recombinant form (CRF). Approximately 10% of all HIV-1 infections involve recombinant viruses, and this high rate of CRFs provided further evidence of HIV-Superinfection (10). The initial studies that identified individuals dually infected with HIV-1 and HIV-2 utilized serological assays that could easily distinguish between the two viral species (7). This approachcannot distinguish between different HIV-1 subtypes or strains. The initial cases of HIV-SI were identified in injecting drug users in Thailand by performing a restriction fragment analysis on amplified viral sequences from longitudinal samples followed by confirmatory viral sequencing (11). At the same time, two separate HIV-SI cases were identified in two homosexual men being monitored as part of larger clinical studies after they experienced unexplained spikes in their set-point viral loads (12,13). Samples from these individuals prior to and after the spike were subsequently analyzed by subtype specific PCR amplification or direct sequencing to confirm the presence of new viral populations. Other groups subsequently utilized these strategies of screening populations for spikes in viral load or subsequent restriction fragment analysis followed by direct sequencing to identify HIV-SI (14). After these initial studies, three diagnostic strategies emerged for screening HIV-SI in populations; heteroduplex mobility assays (HMA), multi region hybridization assays (MHA), and bulk viral sequence analysis followed by selective cloning of those samples that suggested emergence of new viral variants (15-17). MHA screening is limited by the fact that it only can identify inter-subtype superinfection; whereas HMA can detect samples with greater than 1.5% differences in genetic distance. However, HMA is susceptible to false positives due to insertions or deletions. Examining bulk sequencing for changes in the viral population is achieved by either looking for new phylogenetic species at a later time point or quantifying the amount of degenerate bases in a given sequence. [21-25]The sensitivity of this strategy relies on the likelihood of amplifying the new viral population and not just the original strain. Not surprisingly it was found that examining degenerate bases poorly detected minor variants at levels $\leq$20%. Additionally, all these methods require confirmation using cloning and sequencing (18). Aim of the study is to assess the knowledge of superinfection in HIV individuals among dental students and dental practitioners.

2. MATERIALS AND METHODS:

The study was conducted during the academic year december2020 among the he dental students and dental practitioners.

STUDY SAMPLE SIZE:

The descriptive cross sectional study was based among third years (21), final years (19), intern (33) and dental practitioners (32).

INCLUSION AND EXCLUSION CRITERIA:

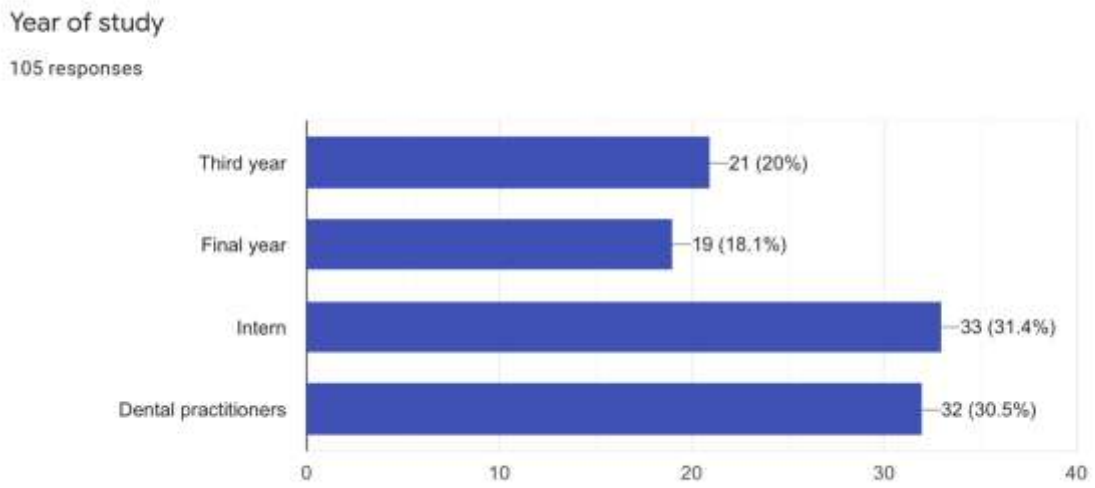
Dental students who were studying 3rd year, final year, doing internship and dental practitioners. Dental students who are not willing to participate were excluded in this study.

QUESTIONNAIRE:

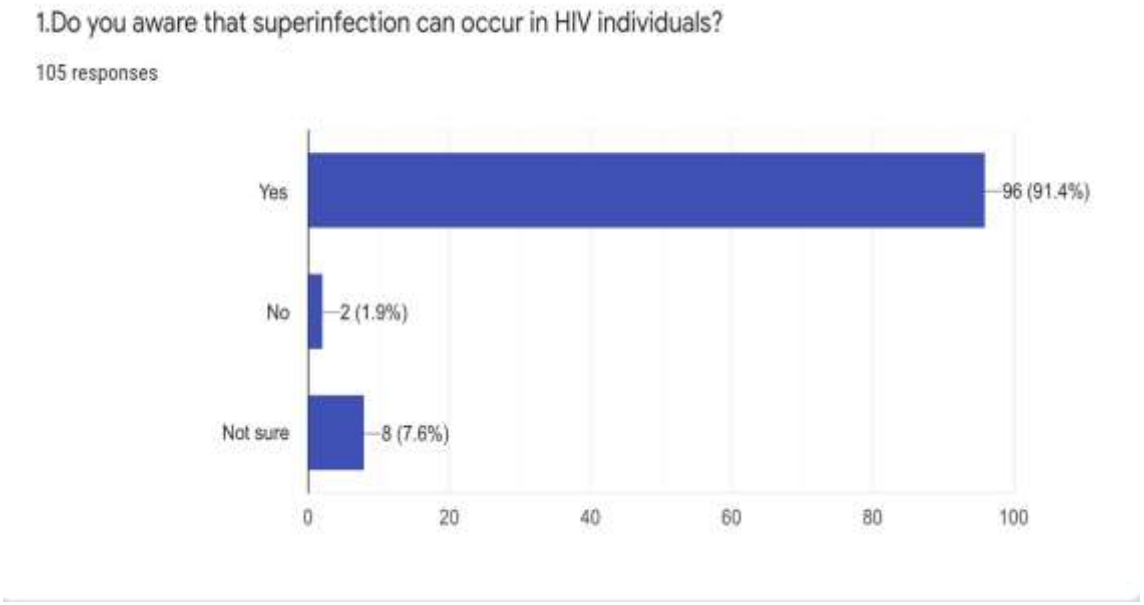
The questionnaire was not targeted at a specific group but all dental students in general to assess their knowledge and awareness about superinfection in HIV individuals. A validated questionnaire was distributed among the dental students and dental practitioners in this study. This included questions about the knowledge of superinfection, types of dual infection, differences between superinfection and coinfections, and various diagnostic assays for detecting superinfections in HIV individuals. The data extracted were tabulated, statistically analysed and results were obtained using SPSS software.

3. RESULTS:

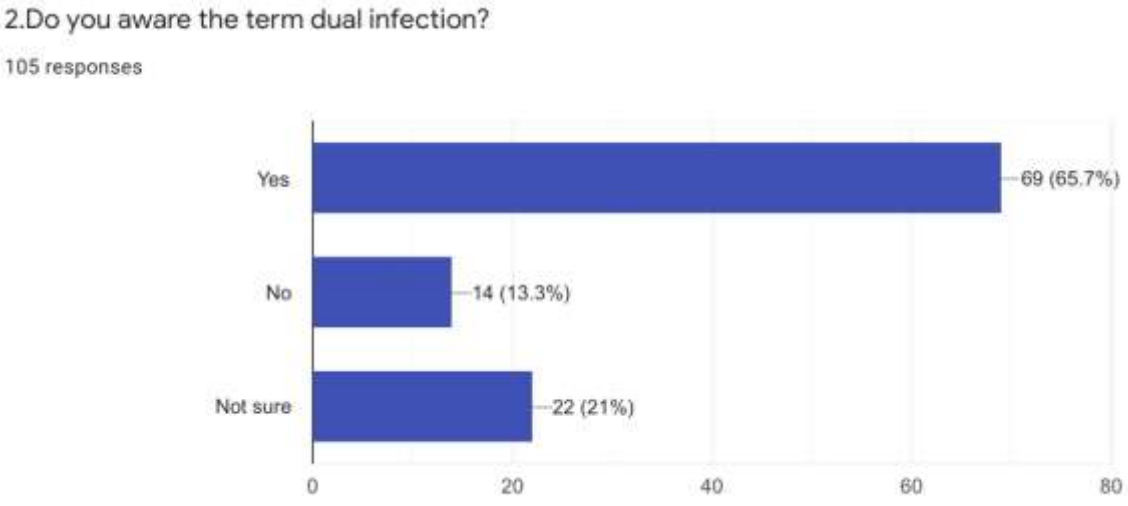
The study populations consisted of 21 third years, 19 final years, 33 interns and 32 dental practitioners.



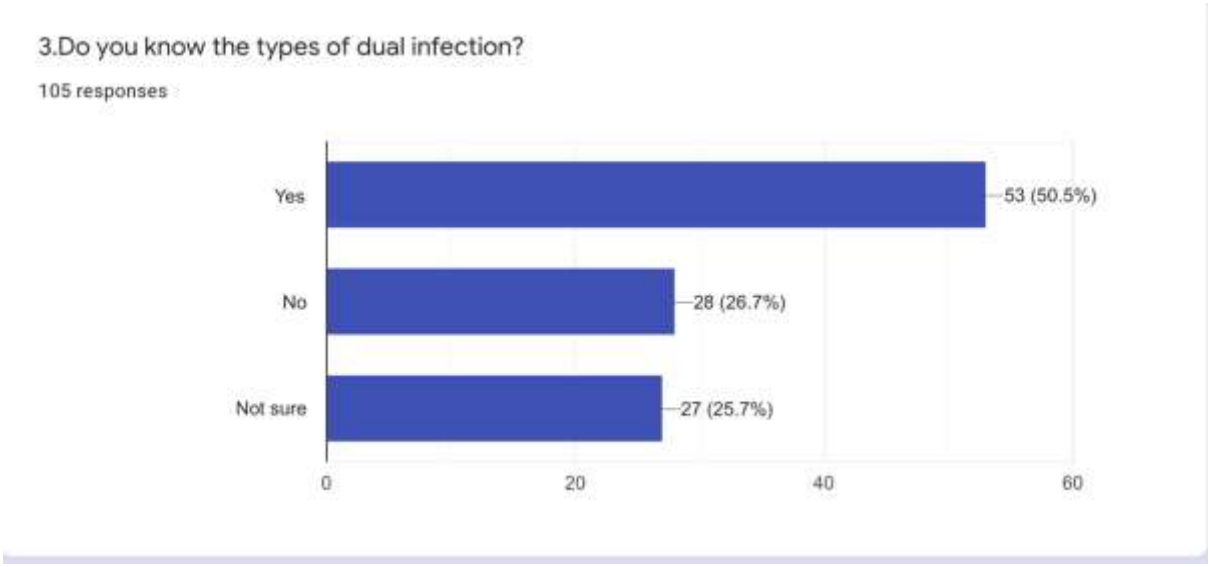
Among the study population, majority of the study population (91.4%) aware that superinfection can occur in HIV individuals, whereas 7.6% of the study population not sure about the superinfection and 1.9% of the study population not aware of superinfection that occur in HIV individuals.



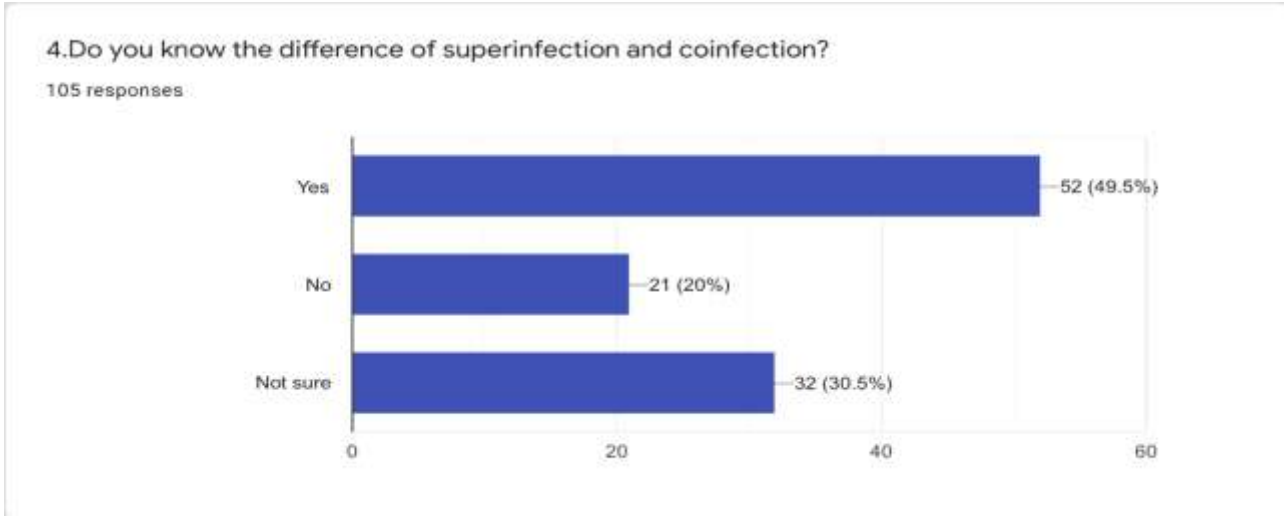
Among the study population, majority of the study population (65.7%) aware about the term dual infection, whereas 21% of the study population not sure about the term dual infection and 14% of the study population didn't know the term dual infection.



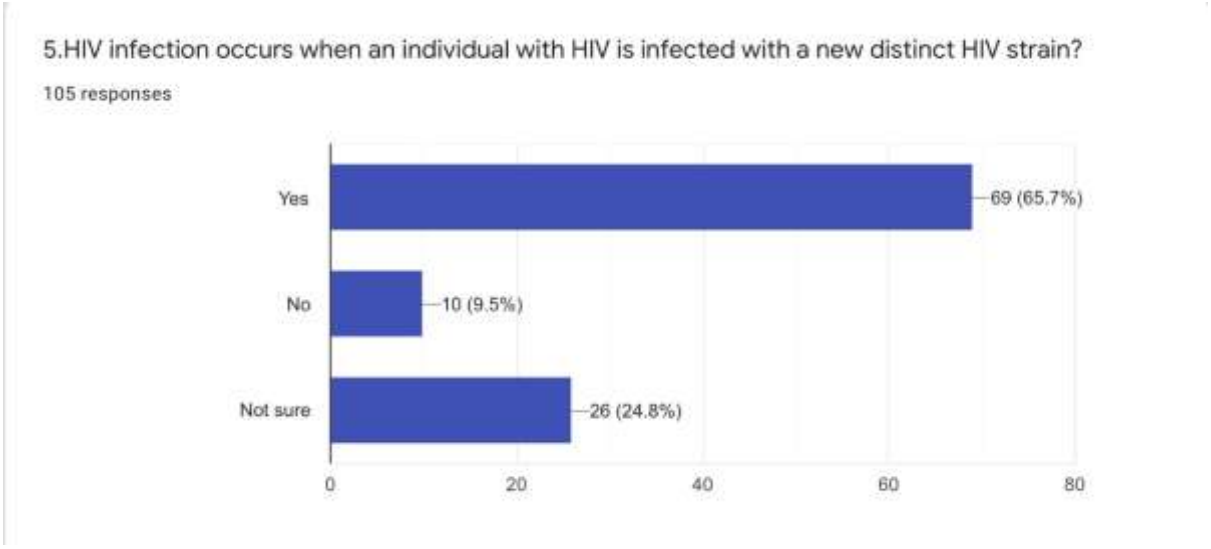
Among the study population, majority of the study population (50.5%) knew about the types of dual infection as superinfection and coinfection, whereas 26.7% of the study population didn't know the types of dual infection and 25.7% of the study population not sure about the types of dual infection.



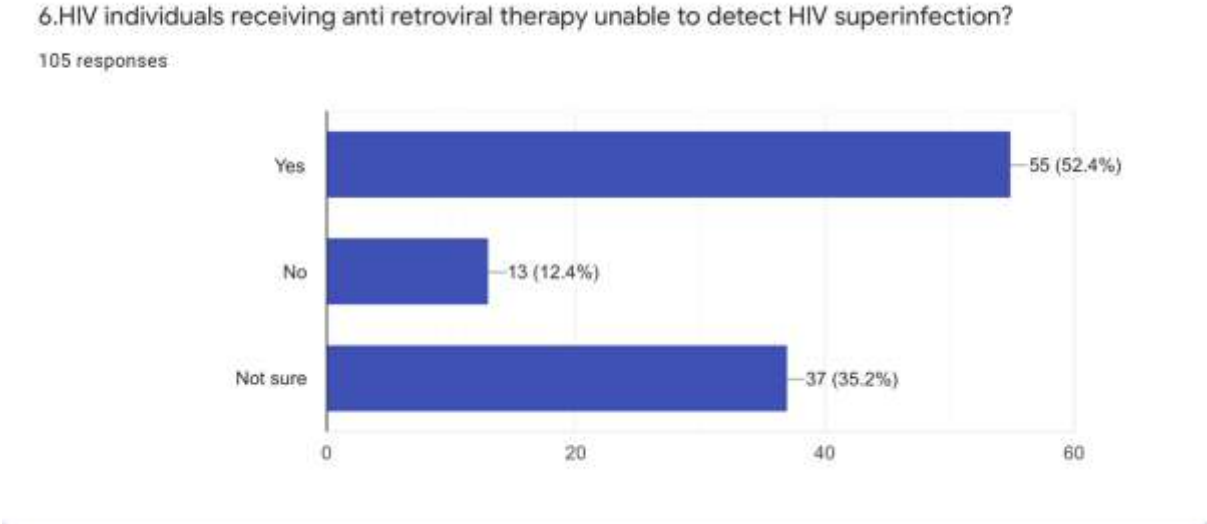
Among the study population, majority of the study population (49.5%) knew the difference between superinfection and coinfectionwhereas 30.5% of the study population not sure about the difference between superinfection and coinfection and 20% of the study population didn't know the difference between superinfection and coinfection.



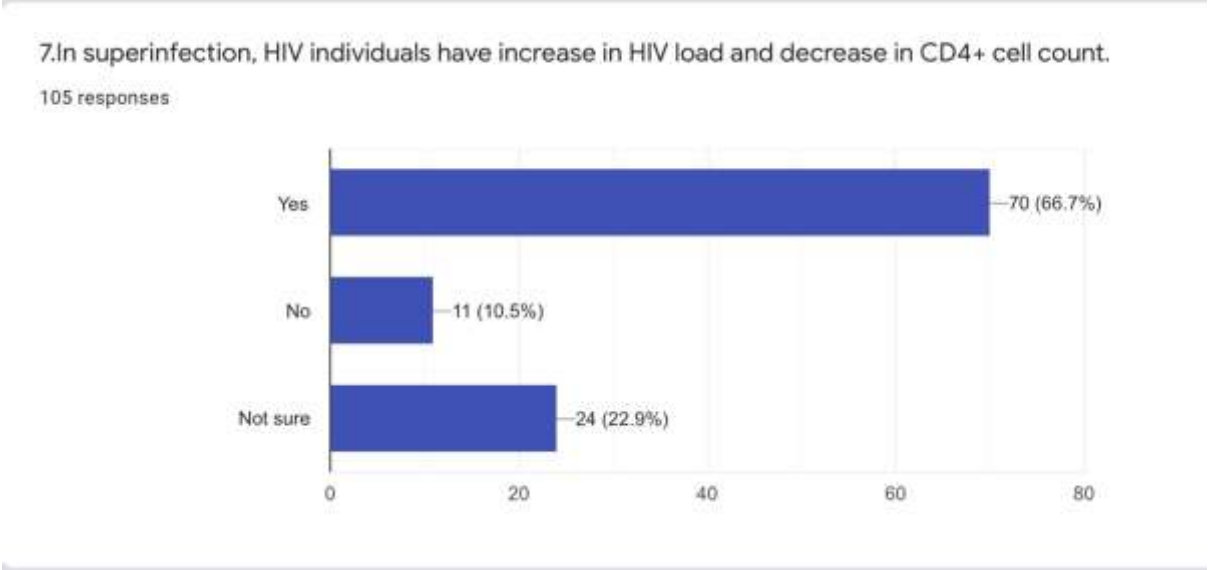
Among the study population, majority (65.7%) told that HIV superinfection occurs when an individual with HIV is infected with a new distinct HIV strain whereas 24.8% of the study population not sure that HIV superinfection occurs when an individual with HIV is infected with a new distinct virus and 9.5% of the study population didn't know that HIV superinfection occurs when an individual with HIV is infected with a new distinct HIV strain.



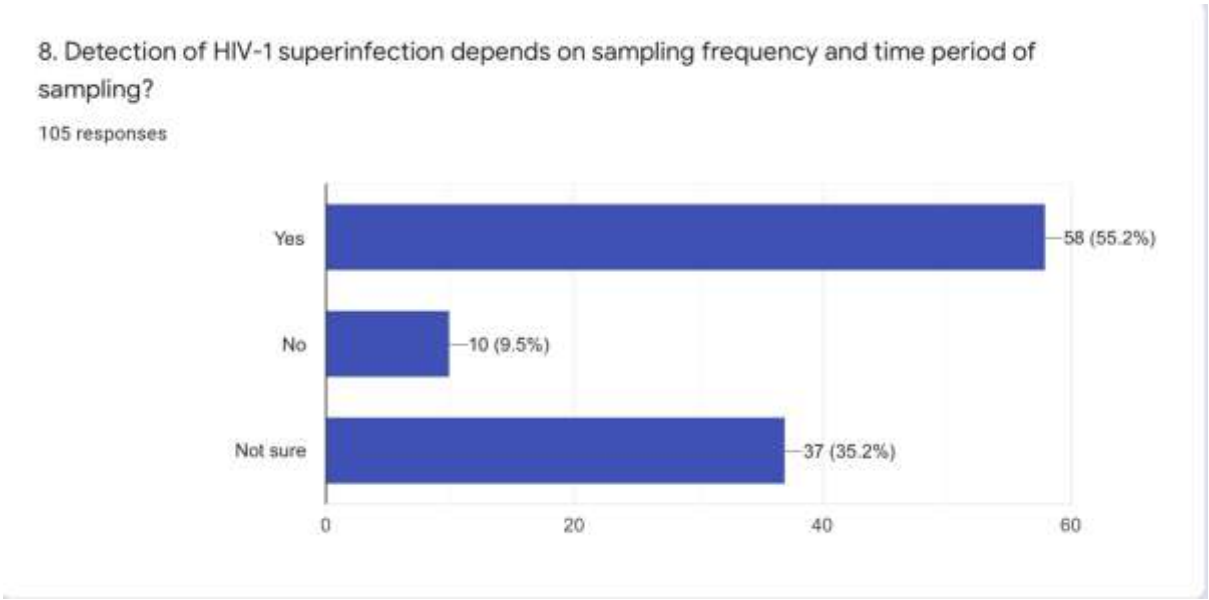
Among the study population, majority(52.4%) told that HIV individuals receiving anti retroviral therapy unable to detect HIV superinfection whereas 35.2% of the study population not sure that HIV individuals receiving anti retroviral therapy unable to detect HIV superinfection and 12.4% of the study population didn't know that HIV individuals receiving anti retroviral therapy unable to detect HIV superinfection.



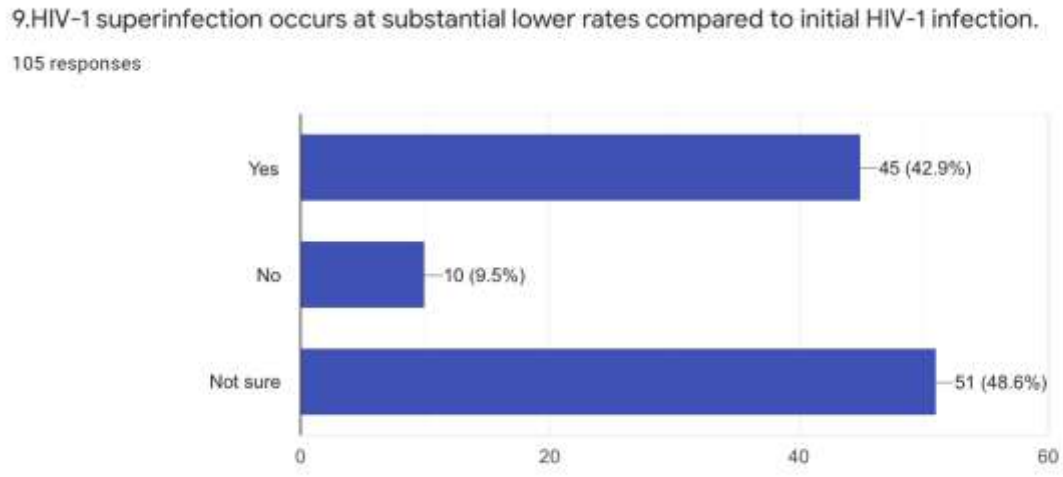
Among the study population, majority (66.7%)knew that in superinfection, HIV individuals have increase in HIV load and decrease in CD4+ cell count whereas 22.9% of the study population not sure that in superinfection, HIV individuals have increase in HIV load and decrease in CD4+ cell count and 10.5% of the study population didn't know that in superinfection, HIV individuals have increase in HIV load and decrease in CD4+ cell count



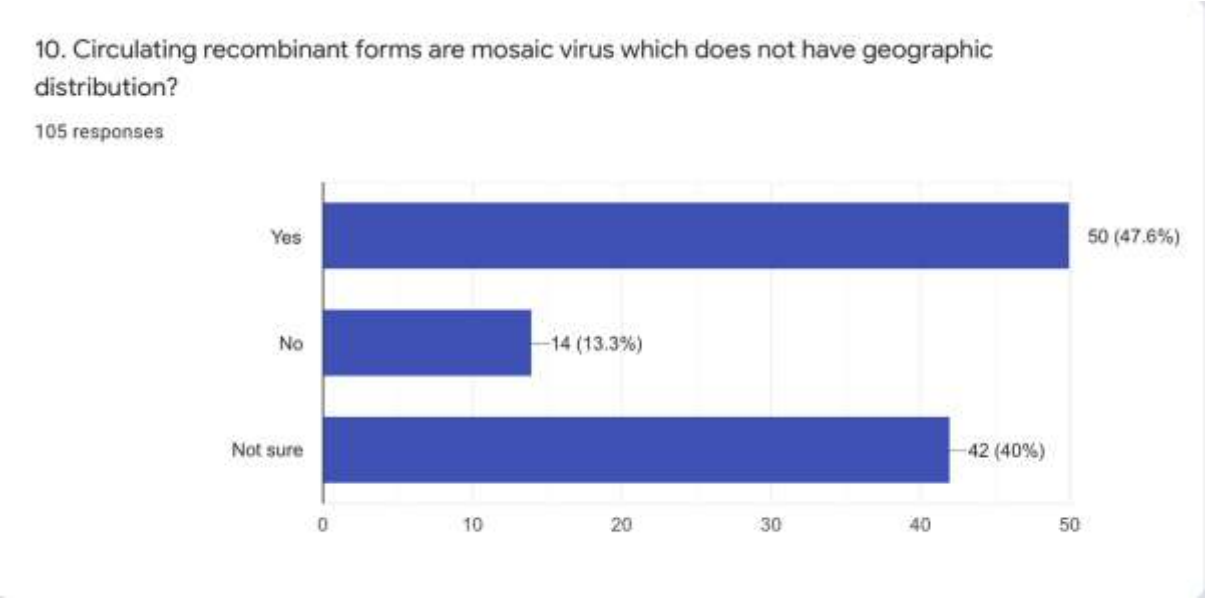
Among the study population, majority (55.2%) aware that detection of HIV-1 superinfection depends on sampling frequency and time period of sampling whereas 35.2% of the study population not sure about the detection of HIV-1 superinfection depends on sampling frequency and time period of sampling and 9.5% of the study population not aware of HIV-1 superinfection.



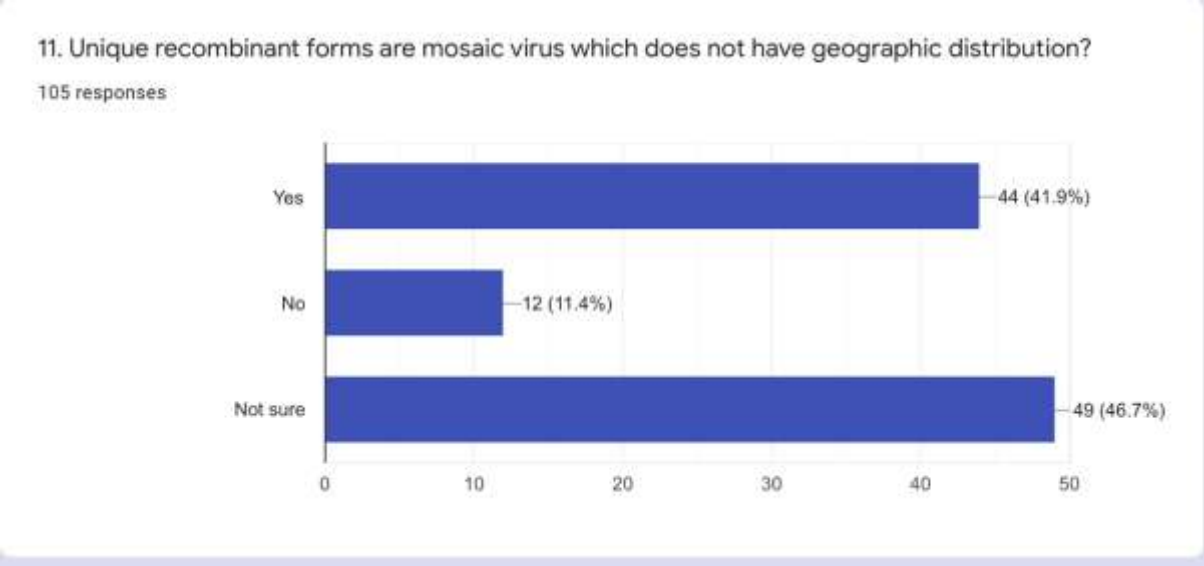
Among the study population, majority (48.6%) not sure that HIV-1 super occurs at substantial lower rates compared to initial HIV-1 superinfection whereas 42.9% of study population aware that HIV-1 aware that HIV-1 superinfection occurs at substantial lower rates compared to initial HIV-1 infection and 9.5% of study population didn't aware of HIV-1 superinfection occurs at substantial lower rates compared to initial HIV-1 infection.



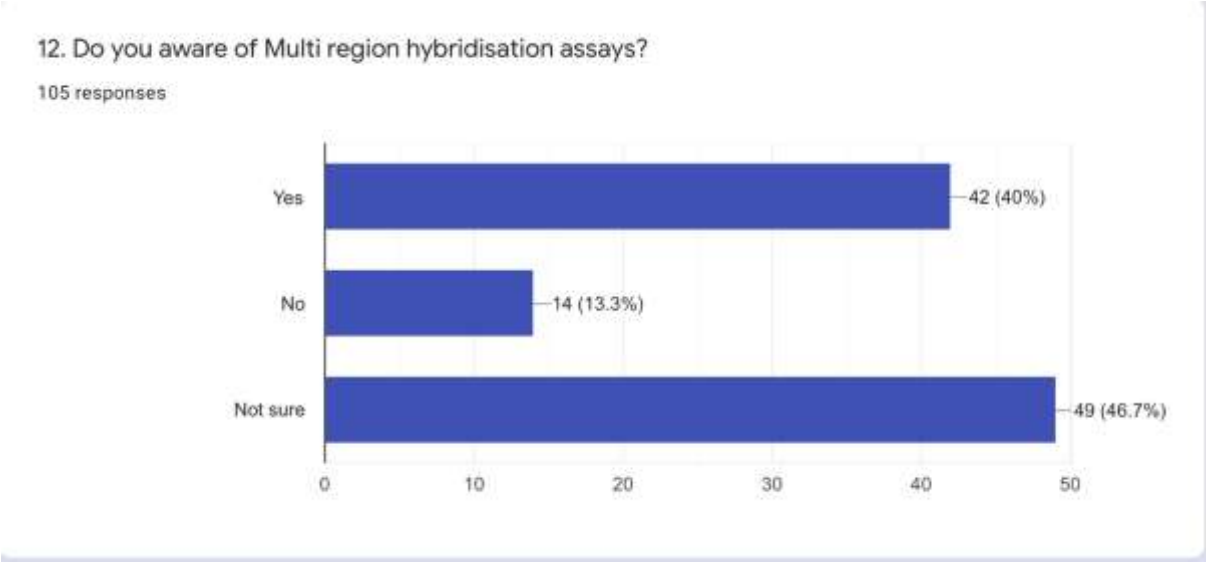
Among the study population, majority (47.6%) of them told that circulating recombinant forms are mosaic virus which does not have geographic distribution, whereas 40% of the study population not sure that circulating recombinant forms are mosaic virus which does not have geographic distribution and only 13.3% of study population aware that circulating recombinant forms are mosaic virus which does have geographic distribution.



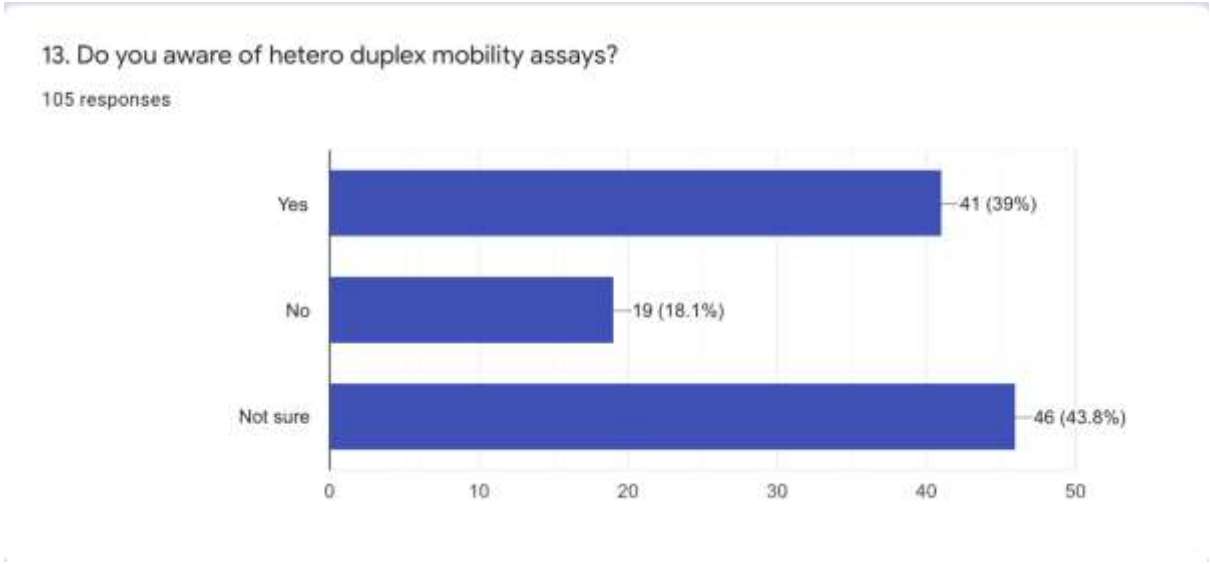
Among the study population, majority (46.7%) not sure that unique recombinant forms are mosaic virus which does not have geographic distribution whereas 41.9% of the study population aware that unique recombinant forms are mosaic virus which does not have geographic distribution and only 11.4% of the study population told that unique recombinant forms are mosaic virus which does have geographic distribution.



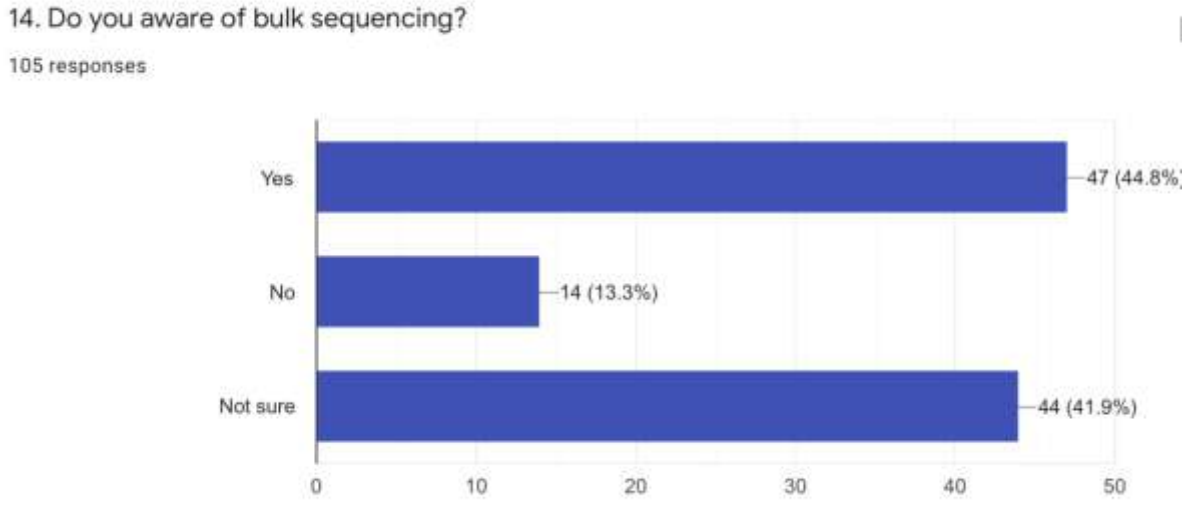
Among the study population, majority (46.7%) not sure about multi region hybridisation assays whereas 40% of the study population aware about multi region hybridisation assays and 13.3% of the study population not aware of multi region hybridisation assays.



Among the study population, majority (43.8%) not sure of hetero duplex assays whereas 39% of the study population aware of hetero duplex mobility assays and 18.1% not aware of hetero duplex mobility assays.



Among the study population, majority (44.8%)of them aware of bulk sequencing whereas 41.9% of the study population not sure of bulk sequencing and 13.3% of study population of not aware of bulk sequencing.



4. DISCUSSION:

HIV-SI has implications for the clinical care of HIV-infected individuals. Transmission of HIV-SI is greater among HIV-infected individuals who do not incorporate safe sexual practices and HIV-SI can potentially lead to increased viral load and disease progression (16). Thus, it is important to encourage safe sexual and injection practices, regardless of HIV infection status. This includes counselling HIV-infected patients on the risk of HIV-SI and

encouraging monogamous relationships, condom use, and use of clean needles. In a study on men's attitudes of HIV-SI among men who had heard of HIV-SI, 82% (135/165) believed that potential HIV-SI could be damaging to their health and 74% (122/165) practiced safer sexual practices due to concern of HIV-SI (20). The most important aspect of men in this study for improving safer sexual practices was learning about the negative health consequences of HIVSI, and if counselling is performed correctly, it could have a substantial positive impact on reducing the risk of HIV-SI. Therefore, we believe that clinicians and other healthcare providers should counsel and give HIV-infected individuals information regarding the possible detrimental effects of HIV-SI as a component of their continuing care (19).

ARV therapy is highly effective in many cases reversing the detrimental clinical effects of HIV infection. With the increased use of ARV around the world, one of the biggest concerns of HIV-SI is the transmission of anti-retroviral drug resistant strains (ARV-resistant) or ARV-susceptible strains masking HIV-resistant strains. There have been reported cases of individuals with ARV-resistant strains acquiring an ARV-susceptible strain and also individuals with an HIV-susceptible strain acquiring an HIV-resistant virus. Due to this negative impact on treatment, clinicians should be aware of the risk of HIV-SI and examine HIV-positive individuals who present with a substantial spike in their viral load or drop in CD4 count for emergence of a new ART-resistance strain. Standard HIV resistance testing soon after these clinical parameters will likely detect the resistance profile of this secondary strain given that the strain is most likely rapidly replicating. However, the advent of ultra-deep sequencing technologies which are becoming cheaper and easier may become more clinically available in the near future for the routine detection of HIV-SI and acquired ARV resistance with the HIV-SI event. HIV transmission is directly related to HIV viral load and transmission is rare among individuals with levels of less than 1500 copies of HIV-1 RNA per milliliter. Recent randomized controlled trial data also confirmed that ARVs substantially reduce HIV transmission. There are no randomized trial data on the impact of ARVs to reduce HIV-SI. However, the majority of HIV-SI cases have occurred prior to ARV initiation or during treatment interruption. In one study of 14 high-risk HIV-seroconcordant couples (28 individuals total) that were all treated with ARV, there were no documented cases of HIVSI.47 With the advent of increased ARV use at earlier time points, this will also hopefully reduce the incidence of HIV-SI, but further research is needed in this area (20).

The immunological aspects of HIV-SI are inherently related to HIV vaccinology, and the initial studies that described HIV-SI all highlighted the significance of their finding on this field. These studies, and others that have observed HIV-SI in a variety of populations, provide a sobering fact for HIV vaccine design, i.e. that natural HIV infection and the host's subsequent immune responses are not fully protective against a new HIV challenge (11-13).

5. **CONCLUSION**:

The results observed in our study showed that knowledge of superinfection in HIV individualsamong dental students and dental practitioners is high. Dental students and dental practitioners were aware of superinfection occurring in HIV individuals but they were not aware of various diagnostic assays for detecting superinfection in HIV individuals. Hence, more awareness programs should be conducted to educate dental students and dental practitioners.

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