

Comparative Study of Nasopharyngeal Swab, Oropharyngeal Swab and Oral Saliva for the Diagnosis of COVID-19

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Abstract: **Introduction:** The world has been affected by COVID-19 in recent years. There are various sampling sites which have given different yields. **Methods:** In cross sectional, prospective and descriptive study, 3 sampling sites namely oropharyngeal (OP), nasopharyngeal (NP) and oral saliva (OS) were compared as regards to COVID-19 yield. **Results:** A total of 939 samples were collected from 313 patients. Among these patients, 16 had samples positive from all three sites. There were 6 patients who had both nasopharyngeal and oropharyngeal swabs which showed positive results for COVID-19, while there were 4 patients each in whom only either oropharyngeal or nasopharyngeal swabs were positive. One patient had positive sample for oropharyngeal and oral saliva, while there was no patient in whom only saliva was positive. Thus a total of 27 patients had atleast one sample which was positive. **Conclusion:** Both nasopharyngeal and oropharyngeal samples are important and also both samples should be taken from all patients in order to reduce false negative results. Oral saliva as the only sampling site cannot be relied on owing to its low yields.

Keywords: Oral saliva, Nasopharyngeal, Oropharyngeal, COVID-19 sample.

1. Introduction

World has been in the grip of Covid-19 pandemic which started in December 2019 in Wuhan China and WHO declared it a pandemic on 11th March 2020 [1], [2]. It caused a huge loss in terms of mortality worldwide and the number of cases kept on fluctuating as the strains of virus keep changing and mutating showing its ugly head now and again. It affected around millions of people worldwide, with many people succumbing to the disease [3], [4]. It has a high R0 of 2 which depicts the number of people an infected patient can affect [5], [13].

Testing of the population is extremely critical for the control of the disease as the positive patients can be treated & their contacts can be traced & isolated to stop further spread the disease. Sampling of these patients involves taking both

oropharyngeal (OP) and nasopharyngeal (NP) swabs [5]-[7]. Both these sampling techniques are partly invasive and often cause discomfort for the patients. One of the noninvasive method of collection of sample is oral saliva [8]-[10]. Saliva can be collected easily by the patient in a container. Scanty literature is available to ascertain the validity of oral saliva as a sampling specimen. This study aimed at finding out the comparison of the sampling sites. In addition, the study also investigated the result of COVID positivity in saliva.

2. Material and Methods

Study participant: All the patients attending COVID-19 Screening OPD of a tertiary care centre and teaching hospital.

Study design: Cross sectional, prospective and descriptive study

Inclusion criteria:

1. All the patients attending COVID-19 Screening OPD

Exclusion criteria:

1. Patients or the guardians not giving the consent.
2. Patients who are tested after treatment or during the course of the disease

All the patients undergoing COVID-19 tests underwent sampling as per standard procedures. OP, NP and oral saliva samples were collected by the resident/faculty of ENT department taking due precautions.

Nasopharyngeal swab were collected by passing the mini tip through the nostril along the floor. Patient's head was tilted backwards and chin steadied. The swab was inserted into the nostril parallel to the palate till resistance was met in nasopharynx. Swab was then held in that position for few seconds and then withdrawn slowly in a firmly rotating motion. The nasal swab was placed in the VTM tube.

After this, OP swab was collected. The patient's head was tilted slightly back and chin steadied. The patient was asked to

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Table 1
COVID-19 positivity in respect to sample site

NP	OP	OS	Number of positive cases	
			N	%
+	+	+	16	59.2%
+	+	-	6	22.2%
-	+	+	1	3.7%
+	-	+	Nil	-
+	-	-	4	14.8%
-	+	-	Nil	-
-	-	-	Nil	-
26 (96.2%) samples positive		23 (85.1%) samples positive	17 (62.9%) samples positive	27 cases positive

open his mouth. The swab was then inserted and sample taken from both the tonsils and posterior pharyngeal wall. The swab was then removed and placed in labeled tube containing VTM. The patients were asked to collect saliva and put in VTM vial.

All the samples were labeled and kept in a cold box and transported to microbiology department. Real Time PCR testing was performed for both the swabs and oral saliva and the result prepared.

3. Results

A total of 313 patients were included in the study. There were 180 (57.5%) male and 133 (42.4%) female patients. Most of the patients tested, belonged to the age group of 20 to 30 years (111, 35.4%).

All the 313 patients underwent sampling from 3 sites; thereby 939 samples were collected in total, results tabulated in Table-I. Among these patients, 16 had samples positive from all three sites. There were 6 patients who had both nasopharyngeal and oropharyngeal swabs which showed positive results, while there were 4 patients in whom only nasopharyngeal swabs were positive. One patient had positive sample for oropharyngeal and oral saliva, while there was no patient in whom only oropharyngeal or saliva was positive. Thus a total of 27 patients had atleast one sample which was positive with a positivity rate of 8.62%. Only NP swabs were positive in a total of 26(96.2%) samples, OP in 23 (85.1%) and OS in 17(62.9%) samples.

4. Discussion

This was a cross sectional, prospective and descriptive study conducted in the departments of ENT and Microbiology in a tertiary care hospital and teaching medical college. There are various sites from which sample can be collected for COVID-19 sampling and this study aimed to find out the comparison of three sites namely nasopharyngeal, oropharyngeal and oral saliva for the COVID-19 yield [11], [12], [14], [15].

As can be seen from the above table, there were 27 patients who were positive for atleast one sample site from a total of 313 patients, thus a positivity of 8.62% was seen. This percentage can vary from 0.5-13%, depending on the time sampling is done.

Sixteen patients showed positivity for all the 3 samples. This can be attributed to the fact, that these patients had large viral loads and thus were picked in all three sites. In six patients, two sites i.e., OP and NP swabs were positive, suggesting that virus tends to settle in upper airways. Similarly 4 samples from only nasopharyngeal swabs were positive, one from only OP and none from OS. The virus harbours more in nasopharynx and

thus this is the best site for sampling and should not be missed though it is important to take the samples from both the NP and OP sites, which definitely increases the yield. Nasopharyngeal sampling is a discomforting procedure for most patients which makes them resist it and a good sample can not be collected. This could be the case in the one patient which came negative for NPS and positive for OPS, Oral saliva as a sampling site did not have the yield matching the OP and NP samples. This could be attributed to the fact that virus has a tendency to affect the airway more profoundly as compared to saliva. A sensitivity of 87.9% has been reported by Meghna et al., for oral saliva from Bihar which was 62.9% in our study [16]. It can also be hypothesized that patients may not be following the proper technique of taking the oral salivary specimen.

5. Conclusion

Samples which yielded higher positivity were from oropharyngeal or nasopharyngeal swabs. There were subjects in whom only OP or NP sample was positive. This leads to a conclusion that both nasopharyngeal and oropharyngeal samples are important and also both samples should be taken from all patients in order to reduce false negative results. Oral saliva as the only sampling site can't be relied on owing to its low yields.

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