

Original Article

## Pre-operative Assessment of Oral *Staphylococcus* and *Candida* Species in a Group of Sri Lankans with Cleft Lip and Palate

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### ABSTRACT

**Objectives:** Cleft lip and palate (CLP) patients are prone to opportunistic infections by *Staphylococcus* and *Candida*. This study aimed to assess oral *Staphylococcus* and *Candida* in a group of Sri Lankans with CLP.

**Material and Methods:** Oral swabs were collected from 52 CLP patients preoperatively upon their informed assent. *Staphylococcus* and *Candida* were isolated microbiologically. Methicillin resistance (MR) of staphylococci was assessed using cefoxitin disk diffusion. *Candida* species were identified using germ tube test and chrome agar.

**Results:** The study included 52 (male=27, female=25) CLP patients (mean age = 9.4 ± 3.6 months). Oral prevalence of *Staphylococcus* and *Candida* were 65.4% (34/52) and 23.1% (12/52), respectively. Whereas 11.5% (6/52) of patients carried both *Staphylococcus* and *Candida*, 11.5% (6/52) had neither organism. Staphylococci included 41.2% (14/34) *S. aureus* and 58.8% (20/34) coagulase-negative staphylococci (CoNS). MR was detected in 57.1% (8/14) of *S. aureus* and 55% (11/20) of CoNS. *Candida* included 58.3% (7/12) *C. albicans* and 41.7% (5/12) non-*C. albicans Candida*.

**Conclusion:** Considering the high prevalence of *Staphylococcus* with MR along with pathogenic *Candida* species, proper infection control practice, and meticulous postoperative care would be mandatory to avoid post-operative complications in CLP patients in this study setting.

**Keywords:** *Candida*, Cleft lip and palate, Methicillin resistance, *Staphylococcus*

### INTRODUCTION

Cleft lip and palate (CLP), the commonest developmental anomaly of the head and neck region, requires surgical correction during early childhood. In an extensive review, Vanderas<sup>[1]</sup> has reported that the incidence of CLP per 1000 births varied among diverse ethnic groups: 0.79-3.74 in the American Indians, 1.45-4.04 in the Chinese and 0.85-2.68 in the Japanese. In India, the incidence of CLP has been approximately 1.1-1.35 per 1000 births.<sup>[2]</sup> Moreover, an early study demonstrated that the incidence of CLP in a group of Sri Lankans was 0.83 per 1000 births.<sup>[3]</sup> This indicates that CLP is a universal health problem across many parts of the world.

Management of patients with CLP involves contributions by multiple specialties, including oral and maxillofacial surgery, orthodontics, speech therapy, along with proper nutrition care.<sup>[4]</sup> The success of the above interventions is indirectly affected by the oral microflora, which could

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transform into pathogens. According to Schonmeyr *et al.*<sup>[5]</sup> dehiscence (3.2%) and infection (1.1%) were the most common types of postoperative complication in CLP patients.

Staphylococci are common inhabitants of the oral cavity of CLP patients.<sup>[6-8]</sup> Supporting the above, it has been reported that the overall prevalence of bacteremia in CLP surgery was 38.1%, and it was largely due to staphylococci.<sup>[9]</sup> Further, Marzoni and Kelly<sup>[10]</sup> have found that the predominant organism responsible for bacteremia following CLP surgery was *S. epidermidis*, a common member of the coagulase-negative staphylococci (CoNS). The foregoing information illustrates the clinical importance of oral staphylococci in CLP surgery.

Commensal yeast, *Candida*, also may affect the management of CLP patients due to its opportunistic nature. Rawashdeh *et al.*<sup>[11]</sup> in a prospective study have reported that the colonization rate of *Candida* in CLP patients was significantly higher than that in the healthy subjects. Another Brazilian study has reported that *Candida* prevalence was as high as 89.5% in cleft palate patients.<sup>[12]</sup> However, there are no previous reports regarding the oral prevalence of *Staphylococcus* and *Candida* in CLP patients from Sri Lanka. Therefore, this study aimed to assess the prevalence of oral *Staphylococcus* and *Candida* in a group of Sri Lankan CLP patients prior to reconstructive surgery.

## MATERIAL AND METHODS

### Study population

A convenient sample of 52 CLP patients who underwent their first reconstructive surgery at the Department of Oral and Maxillofacial Surgery, Faculty of Dental Sciences, University of Peradeniya, Sri Lanka, over 6 months (November 2019-April 2020) were recruited for the study after obtaining the informed assent from the parents/guardians. Patients who had antibiotic treatment during the last three months, the presence of oral or systemic pathological conditions other than CLP, and the use of oral appliance therapy were excluded. Demographic data of the patients were collected using an interviewer administered structured questionnaire. Ethics clearance for the study was obtained from the ethics review committee of the Faculty of Dental Sciences, University of Peradeniya, Sri Lanka (ERC/FDS/UOP/I/2020/12).

### Microbiological assessment

Oral microbiological samples were collected using a sterile cottonswab by an experienced consultant oral and maxillofacial surgeon (WMPSKW) by circling with even pressure on the oral mucosa of the CLP patients preoperatively following a method described earlier.<sup>[13]</sup> Collected swab samples were transported immediately for microbiological assessment, and

they were cultured on blood and Sabourad's agar plates and incubated for 24-48 hours. Culture plates were observed, and *Staphylococcus* species were identified using Gram staining, catalase, coagulase, and DNase tests. Methicillin resistance in *Staphylococcus* species was assessed using a cefoxitin disk (30 mg) diffusion assay following the procedures of the Clinical Laboratory Standard Institute (CLSI M100).<sup>[14]</sup> Gram staining, germ tube test and chrome agar tests were used for specific identification of *Candida* species.

## RESULTS

The study sample consisted of 52 CLP patients, 27 males and 25 females. Their mean age was  $9.4 \pm 3.6$  months (range, 4-18 months). Overall, there were 26 patients with cleft lip, 14 patients with cleft palate, and 12 patients with cleft lip and palate [Table 1].

The oral prevalence of *Staphylococcus* species was 65.4% (34/52), and *Candida* species was 23.1% (12/52). At the same time, 11.5% (6/52) of the samples carried both *Staphylococcus* and *Candida* and another 11.5% (6/52) of the samples produced neither *Staphylococcus* nor *Candida* in culture.

*Staphylococcus* species consisted of 41.2% (14/34) of *S. aureus* and 58.8% (20/34) CoNS. Methicillin resistance was detected in 57.1% (8/14) of *S. aureus* (MRSA) and 55% (11/20) of CoNS isolates.

*Candida* species included 58.3% (7/12) *C. albicans* and 41.7% (5/12) non-*C. albicans* *Candida*.

## DISCUSSION

Nearly 65% of patients in this study harbored oral staphylococci, corroborating the previous studies that have reported increased oral prevalence of staphylococci in CLP patients.<sup>[6,8,13,15]</sup> It is important to note that staphylococci are frequent skin and nasal commensals. CLP involves oral communication with the facial skin and the nasal mucosa,

**Table 1:** Demographic data and the oral prevalence of *Staphylococcus* and *Candida* species in CLP patients.

Age	9.4 ± 3.6 months
Gender	Male = 27, Female = 25
Cleft type	Cleft lip = 26, Cleft palate = 14 Cleft lip and palate = 12
<i>Staphylococcus</i> species were isolated	65.4% (34/52)
<i>Candida</i> species were isolated	23.1% (12/52)
Both <i>Staphylococcus</i> and <i>Candida</i> species were isolated	11.5% (6/52)
Neither <i>Staphylococcus</i> nor <i>Candida</i> species were isolated	11.5% (6/52)

CLP: cleft lip and palate.

which may often lead to contamination and subsequent oral colonization of staphylococci, resulting in high oral prevalence in CLP patients. Moreover, staphylococci isolated in the current study included both *S. aureus* 41.2% (14/34) and CoNS 58.8% (20/34), denoting a predominance of CoNS in the oral microflora of CLP patients. Resembling the above findings, Marzoni and Kelly<sup>[10]</sup> have found an increased prevalence of bacteremia due to coagulase-negative *S. epidermidis* in a group of CLP patients following reconstructive surgery. Furthermore, it has been reported that the overall prevalence of bacteremia during and after CLP surgery was 38.1%, and the responsible bacteria included both CoNS and *S. aureus*.<sup>[9]</sup> As such, based on the preceding information, it is conceivable that many CLP patients carry oral staphylococci, both *S. aureus* and CoNS, posing a threat of postoperative bacteremia.

However, only a few studies have assessed the preoperative microflora and the postoperative infections in CLP patients. According to Schonmeyr *et al.*<sup>[5]</sup> the incidence of postoperative infection in CLP patients was as low as 1%, even without antibiotics. Several other investigators have observed no perfect correlation between the microbiological culture results with the postoperative outcome, regardless of antibiotic therapy.<sup>[13,16]</sup> Current study also was limited to the preoperative assessment of oral microflora of the CLP patients. Therefore, further prospective studies are warranted to explore the relationship between the oral microflora and the postoperative outcome of CLP patients.

Remarkably, more than 50% of *S. aureus* and CoNS isolated in our study demonstrated methicillin resistance (MR). In contrast, Chuo and Timmons<sup>[15]</sup> found only 2 isolates (1.7%) with MR within a collection of 86 *S. aureus* isolates from CLP patients previously. Moreover, Tuna *et al.*<sup>[7]</sup> who have investigated a group of 32 CLP patients with oronasal communication observed no MRSA but MSSA. In a group of 44 CLP patients, there was a significantly higher rate of colonization by staphylococci without any MRSA.<sup>[9]</sup> Accordingly, the increased prevalence of MRSA among CLP patients in the current sample indicates the necessity for strict infection control, judicious antibiotic use, and meticulous follow-up of the patients in order to avoid postoperative complications.

*Candida* prevalence was approximately 23%, which included both *C. albicans* (58%) and non-*C. albicans Candida* (42%). In a similar study, *Candida* species in CLP patients was found to be 89.5%, and *C. albicans* was the leading species compared with non-*C. albicans Candida*.<sup>[12]</sup> Furthermore, in a group of 46 CLP patients, *Candida* prevalence amounted to 39% and included both *C. albicans* and non-*C. albicans Candida*.<sup>[17]</sup> Another study has revealed that 65.9% of CLP patients had

oral *Candida* predominantly with *C. albicans*.<sup>[18]</sup> Though the prevalence of oral *Candida* in our sample is lesser than that in the above reports, the majority harbored *C. albicans*, which is known to be the primary pathogen and efficient biofilm producer. Hence, it would be pertinent to promote oral hygiene in CLP patients to avoid *Candida* overgrowth, considering the capability of *Candida* to create biofilm-associated infections.<sup>[19]</sup>

Intriguingly, there were 06 (11.5%) CLP patients carrying both staphylococci and *Candida* species in their oral cavities. Symbiotic relationships with regard to the pathogenesis of these commensals have already been uncovered, and it has been suggested that *C. albicans* facilitates the invasion of *S. aureus* across breached mucosal barriers, leading to systemic infection in co-colonized patients.<sup>[20]</sup> Accordingly, the concomitant presence of staphylococci and *Candida* in CLP patients may increase the risk of postoperative bacteremia, leading to complications, and warrants further investigation on the clinical implications.

One of the drawbacks of this study is that it included only a limited number of participants, and the postoperative follow-ups were not reported. However, the findings showed that potentially pathogenic *Staphylococci* with MR and *Candida* exist in the preoperative microflora of CLP patients. The clinical impact of such microbiological findings would have been better elucidated by assessing the postoperative complications of such patients. Hence, further studies with a bigger sample size and postoperative clinical follow-ups would be beneficial to demonstrate the significance of the oral microflora of CLP patients in this clinical setting.

## CONCLUSION

In conclusion, CLP patients undergoing reconstructive surgery may carry potential pathogens such as staphylococci and *Candida* in their oral microflora, with or without antibiotic resistance. Proper oral hygiene, asepsis, and close monitoring after reconstructive surgery may be imperative to avoid postoperative infections in CLP patients.

## Author contribution

All authors contributed to the study's conception and design. Sample collection was done by WMPSKW. Data collection, material preparation, microbiological assessments, and data analysis were performed by HKW, MRDMS, and SHKW under the supervision of JAMSJ. The first draft of the manuscript was written by JAMSJ, and all authors commented on previous versions of the manuscript. All authors read and approved the final manuscript.

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## Ethical approval

The research/study was approved by the Ethics Review Committee of the Faculty of Dental Sciences, University of Peradeniya, Sri Lanka, ERC/FDS/UOP/I/2020/12, dated 2020.

## Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent.

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Nil.

## Conflicts of interest

There are no conflicts of interest.

## Use of artificial intelligence (AI)-assisted technology for manuscript preparation

The authors confirm that there was no use of Artificial Intelligence (AI)-Assisted Technology for assisting in the writing or editing of the manuscript and no images were manipulated using AI.

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