Effect of Denture Wearing on Occurrence of *Candida* Species in the Oral Cavity

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ABSTRACT

Degradation of oral health is often assumed to progress with aging. However, significantly higher total counts and greater varieties of *Candida* species can be detected in wearers of removable dentures compared with non-denture wearers. Denture wearing constitutes a stable factor that can affect oral health status. Its impact is almost unaffected by aging. This should be taken into account when making predictions and assessments concerning oral health management for middle-aged and elderly subjects.

INTRODUCTION

Candida has been recognized as a part of the normal oral flora without any harmful effects.[1,2] There are 300 to 400 species of microorganisms in the oral cavity, including 20 species of *Candida*. Changes in the oral environment effected by tooth loss or denture wearing can cause changes in oral microflora.[3] *Candida* is not harmful in healthy hosts, but may cause opportunistic infections in immunocompromised hosts, such as patients suffering from AIDS, leukemia, or head or neck cancer.[4-6] Oral candidiasis has been reported to be associated with candidiasis in the lung and deglutition pneumonia.[7]

The amount of *Candida* has been found to increase in elderly individuals,[8-10] but most previous investigations focused solely on *Candida albicans*. Few studies concerning non-*C albicans* species have been conducted. No previous reports about the relationship between denture wearing and the occurrence of either *C albicans* or non-*C albicans* species in the oral cavity exist to the knowledge of the authors. In 1 study, *Candida tropicalis* and *Candida glabrata* were shown to be resistant to fungicides.[11]

This study suggests that non-*C albicans* species should be taken into account when trying to preserve oral health in middle-aged or elderly subjects. While providing dental care guidance to people in rural Japan, the authors conducted mass screenings about local conditions of oral health. Within this context, distribution characteristics of *Candida* species in subjects wearing or not wearing full or partial removable dentures were investigated.

Table 1. Age, Sex, and Denture Wearing Status of Subjects

	Men		Women		
Age Group	DWs	NDWs	DWs	NDWs	Total
≤39	0	21	0	38	59
40-49	3	18	6	43	70
50-59	3	15	12	26	56
≥60*	25	19	40	17	101
Total	31	73	58	124	286

DWs: denture wearers; NDWs: nondenture wearers.
*The oldest individual surveyed was 83 years.

SUBJECTS AND METHODS

Subjects

Two hundred eighty-six subjects (104 men and 182 women) underwent dental screening in rural areas of Hokkaido, Japan. Age distribution and denture wearing status of these subjects are shown in Table 1.

Investigation of *Candida*

Collected oral rinse samples from the subjects were cultured on CHROMagar Candida plates (CHROMagar, Paris, France) by the method of Beighton et al.[12] The subjects rinsed with 10 mL of Phosphate-Buffered Salines(PBS) for 15 minutes, and 100 μL of collected buffer were seeded on the plates, and then cultured for 48 to 72 hours at 37ºC.

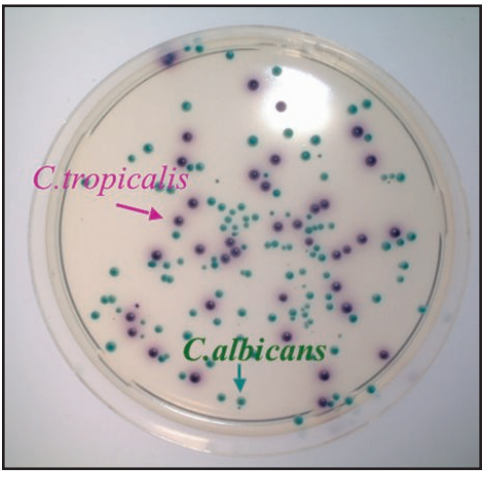

Figure 1. Typical colony formation in CHROMagar plate

Candida species were determined as colony forming units for each individual. Characteristically, *C albicans* exhibited green, *C tropicalis* exhibited purple, and *C glabrata* exhibited dark pink colors. *Geotrichum* species, unlike *C albicans*, formed small, rough colonies of pale green appearance (Figure 1). An API 20C AUX kit (BIOMERIEUX, France) was used for identification.

Results

No subjects under the age of 39 wore dentures. The detection rate of all *Candida* species, single and multiple combined, was 40.6% of the total of subjects in this youngest age group (Figure 2). Among the subjects who were 40 to 49 years of age, the *Candida* detection rate was higher in denture wearers (66.7%) than in nondenture wearers (39.3%). In the group of 50 to 59 year-old individuals, the rate of *Candida* detected in denture wearers (73.3%) was significantly higher ($P<0.05$) than that of subjects not wearing dentures (34.1%). *Candida* detection rates observed in the subjects who were 60 to 65 years of age were 66.2% and 41.7%, respectively, ($P<0.05$).

This study indicates that, although detection rates of single *Candida* species were rather high in the youngest group of nondenture wearers, detection rates of single and multiple *Candida* species were significantly higher in denture

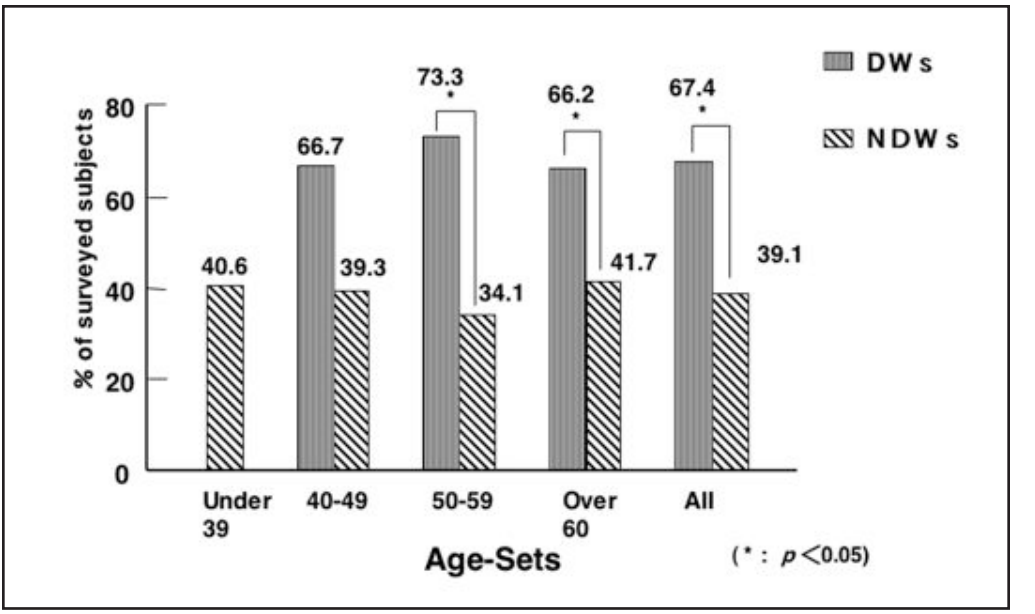

Figure 2. Total count of *Candidas* in each age-set.
(Example: In 66.7% of the population of 40-49 years old denture wearers, single or multiple species of *Candida*s were detected)

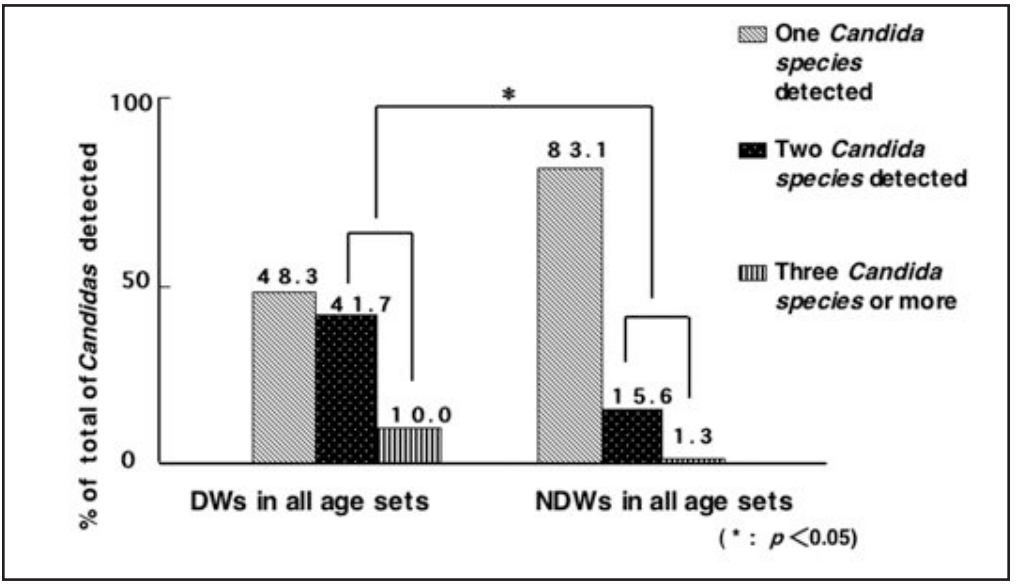

Figure 3. Which categories of *Candidas* constitute the entire count of *Candidas* detected in DWs or NDWs. (Example: Among all *Candidas* detected in denture wearers of all age sets, single *Candida* species represented 48.3%)

wearers of all other age groups compared with individuals not wearing dentures. Denture wearing correlated with significant rises in detection rates of single and multiple *Candida* species in all of these groups, a condition that was not affected by age progression from 40 to 81 years. When denture wearers of all age groups were pooled and compared with the total of nondenture wearers, a

Table 2. Detection of Single or Multiple Candida Species in Denture Wearers or Nondenture Wearers

Denture wearers (n=60)

Detected Species	CA	CT	CG	G spp	CP	CK	No. of Subjects (%)
	+	-	-	-	-	-	17 (28.3)
	+	+	-	-	-	-	12 (20.0)
	+	-	+	-	-	-	6 (10.0)
Positive	+	-	-	+	-	-	4 (6.7)
Species	-	+	-	-	-	-	6 (10.0)
	-	+	-	+	-	-	1 (1.7)
	-	+	-	-	+	-	1 (1.7)
	-	-	+	+	-	-	1 (1.7)
	-	-	-	+	-	-	4 (6.7)
	-	-	-	-	-	+	2 (3.3)
	+	+	+	-	-	-	1 (1.7)
	+	+	-	-	-	+	2 (3.3)
	+	-	+	-	+	-	1 (1.7)
	-	+	-	+	+	-	1 (1.7)
	+	+	-	+	-	+	1 (1.7)
	44	25	9	12	3	5	60

Nondenture wearers (n=77)

Detected Species	CA	CT	CG	G spp	CP	CK	No. of Subjects (%)
	+	-	-	-	-	-	46 (59.7)
	+	+	-	-	-	-	3 (3.9)
	+	-	+	-	-	-	4 (5.2)
Positive	+	-	-	+	-	-	2 (2.6)
Species	+	-	-	-	+	-	1 (1.3)
	-	+	-	-	-	-	7 (9.1)
	-	-	+	-	-	-	3 (3.9)
	-	-	+	+	-	-	1 (1.3)
	-	-	-	+	-	-	3 (3.9)
	-	-	-	+	+	-	1 (1.3)
	-	-	-	-	+	-	4 (5.2)
	-	-	-	-	-	+	1 (1.3)
	+	+	-	-	-	+	1 (1.3)
	57	11	8	7	6	2	77

CA: *Candida albicans*; CT: *Candida tropicalis*; CG: *Candida glabrata*; G spp: *Geotrichum* spp; CP: *Candida* spp; CK: *Candida krusei.*

higher occurrence of multiple *Candida* species significantly characterized denture wearers (Figure 3).

DISCUSSION

In Japan, the elderly population has increased, and this requires corresponding improvements in health care and medical technology. Citizens who were older than 65 years of age represented 12% of the overall Japanese population in 1990, 17% in 2000, and are expected

to reach 21.3% in 2010.[13] Prevention of oral diseases and oral health care is a prerequisite for quality of life in this population. Ideally, 20 teeth or more should be preserved to warrant acceptable mastication and food intake even up to the age of 80 years.[14]

Aging has been believed to cause progressive increases of *Candida* in the oral cavity. However, this study showed that the sole factor of denture wearing affected the number of *Candida* species detected as well as total *Candida* counts, independent of the age of the denture wearer (Figure 2). Accounting for the stable, constant factor of denture wearing and its effects could provide reliability and perspective to oral health assessments, which, when observing age or other data in isolation, might easily go astray.

Frequent occurrence of multiple *Candida* species sets denture wearers apart from subjects who do not wear dentures. Denture wearing is supportive of growth of species as *C albicans*, *C tropicalis*, and *C glabrata* (Table 2).

Distinguishing conditions among those who wear dentures from those who do not could permit clinical approaches that are better tailored to each group. Observing a single *Candida* spp alone is likely to afford a less conclusive picture. CHROMagar Candida was only one of many devices that could be used to assess the cleanliness of dentures and general oral hygiene in concerned subjects.

Denture wearing as a significant factor should not be neglected when providing oral hygienic guidance for middle-aged subjects. In elderly individuals, even broader health concerns are involved. Controlling *Candida* through appropriate denture management guidance is important in promoting general health throughout such generations.

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