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# Effect of phenotype switched *Candida auris* mono-culture and co-culture biofilms on the morphology, viability, and adhesion of hTERT TIGKs and ORL-48 cell lines

[Archives of Oral Biology](#) • Article • [Open Access](#) • 2026 • DOI: 10.1016/j.archoralbio.2025.106478 [📄](#)[Zainal, Mukarramah](#)<sup>a, b, c</sup> [✉](#); [Sarmin, Nurul 'Izzah Mohd](#)<sup>b, d</sup>; [Ibrahim, Mohammad Johari](#)<sup>e</sup>; [Cirillo, Nicola](#)<sup>f</sup>; [Dashper, Stuart G.](#)<sup>f</sup>; [+1 author](#)<sup>a</sup> Department of Fundamental Dental & Medical Sciences, Kulliyah of Dentistry, International Islamic University Malaysia, Pahang, Kuantan, 25200, Malaysia[Show all information](#)

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## Abstract

**Objectives:** This study aims to determine the paracrine effects of *Candida auris* phenotypic switching in mono- and co-culture with *Staphylococcus aureus* on oral epithelial homeostasis and oncogenic progression in phenotypically normal (hTERT TIGKs) and malignant (ORL-48) oral keratinocytes. **Design:** *C. auris* switched phenotype was scored using Phloxine B, and mono- and co-culture biofilms with *S. aureus* were developed. hTERT TIGKs and ORL-48 cell lines were independently seeded into 6-well and 96-well plates for dispase and viability test, respectively. The oral cell lines were exposed to phenotypically switched *C. auris* mono- and co-culture biofilm test cell growth medium (TCGM) for 24 h. Outcomes included cell morphology, metabolic activity/viability (CCK-8), and cell–cell adhesion (dispase assay). **Results:** Microscopic observation revealed that the biofilm induced damage and disrupted epithelial cell integrity in a paracrine manner. The mono- and co-culture TCGM suppressed the growth of normal cells while promoting the metabolic activity of cancer cells. The adhesion analysis of hTERT TIGKs indicated a strong intercellular cohesion, while ORL-48 cells downregulated intercellular adhesion and compromised cell-cell cohesion. **Conclusion:** *C. auris* biofilms promote the development of a malignant phenotype by regulating cell viability, promoting epithelial-mesenchymal transition, and adhesion in a switched generation-dependent manner. © 2025

## Author keywords

Biofilm; *Candida auris*; EMT; hTERT TIGKs; Interkingdom interaction; Oral carcinogenesis; ORL-48; Phenotype switch; *Staphylococcus aureus*

## Indexed keywords

### MeSH

Biofilms; *Candida auris*; Cell Adhesion; Cell Line; Cell Survival; Coculture Techniques; Humans; Keratinocytes; Phenotype; *Staphylococcus aureus*

### EMTREE drug terms

dispase; telomerase reverse transcriptase; transforming growth factor alpha

### EMTREE medical terms

Article; biofilm; biofilm formation; cancer growth; *Candida auris*; carcinogenesis; cell adhesion; cell density; cell growth; cell structure; cell viability; cell viability assay; coculture; colony formation; controlled study; dissociation; enzyme assay; epithelial mesenchymal transition; epithelium cell; fungus culture; fungus growth; fungus hyphae; homeostasis; human; human cell; keratinocyte cell line; microscopy; monoculture; morphology; mouth cancer; mouth epithelium; nonhuman; oral cancer cell line; oral squamous cell carcinoma cell line; ORL-48; phenotype; quantitative assay; *Staphylococcus aureus*; Telomerase Immortalized Gingival Keratinocyte; turbidity; cell line; cell survival; coculture; cytology; growth, development and aging; keratinocyte; microbiology; phenotype; physiology

## Device trade names

Commercial names given to devices, used for branding and differentiation in the market, commonly referenced in scientific and clinical research.

Tradename	Country	Manufacturer
Multiskan SkyHigh	Italy	Thermo
Countess		Invitrogen
Prism Version 10.05.01		Graphpad

## Chemicals and CAS Registry Numbers

Unique identifiers assigned by the Chemical Abstracts Service (CAS) to ensure accurate identification and tracking of chemicals across scientific literature.

dispase 42613-33-2

telomerase reverse transcriptase 120178-12-3

## Funding details

Details about financial support for research, including funding sources and grant numbers as provided in academic publications.

Funding sponsor	Funding number	Acronym
University of Melbourne <a href="#">See opportunities by UNIMELB</a> ↗		UNIMELB
Melbourne Dental School		
International Islamic University Malaysia		
Cancer Research Malaysia		
International Islamic University Malaysia <a href="#">See opportunities by IIUM</a> ↗	RISE25-006-0006	IIUM
International Islamic University Malaysia <a href="#">See opportunities by IIUM</a> ↗		IIUM
Ministry of Higher Education, Malaysia <a href="#">See opportunities by MOHE</a> ↗	FRGS/1/2022/SKK11/UIAM/02/2	MOHE
Ministry of Higher Education, Malaysia <a href="#">See opportunities by MOHE</a> ↗		MOHE

### Funding text 1

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