Point of Care Testing Device for Screening Alzheimer's Disease Using Salivary Lactoferrin as a Biomarker

Shin, Songyeon (School: Korean Minjok Leadership Academy)
Kim, Donghyun (School: Korean Minjok Leadership Academy)
Kim, Hayoon (School: Korean Minjok Leadership Academy)

Alzheimer’s disease is a progressive and ultimately fatal neurodegenerative disorder affecting over 55 million people worldwide. Although early diagnosis is critical, up to 75% of dementia patients remain undiagnosed due to limited accessibility of standard diagnostic approaches– such as CSF assays and neuroimaging– as they are often expensive, invasive, and not suitable for point-of-care testing(POCT). Lactoferrin, a salivary protein, has recently emerged as a promising biomarker for Alzheimer’s disease, as it indicates hypothalamic lesions, one of the earliest pathological changes occurring prior to neurodegeneration. However, conventional methods for measuring salivary lactoferrin, such as ELISAs, remain costly and require specialized laboratory equipment, limiting accessibility. Therefore, we aimed to develop a cost-effective and easily accessible way to quantify salivary lactoferrin levels for Alzheimer’s diagnosis. Based on the iron-binding properties of lactoferrin, we designed an antibody-free detection strategy to assess lactoferrin levels solely through color change, quantitatively analyzed using image-based analysis. To confirm clinical applicability, we analyzed human saliva samples and observed a statistically significant difference in colorimetric response between Alzheimer’s disease patients and healthy controls ($p = 0.00168$). Finally, we developed a POCT kit with a web-based platform for automated result analysis and interpretation. At approximately $0.20 per test, the proposed assay is about 50 times more cost-effective than conventional ELISA-based methods. Conclusively, this system provides a rapid and accessible approach for Alzheimer’s disease screening with strong potential for early diagnosis and large-scale community screening.

Awards Won:
Fourth Award of $600