学位論文内容の要旨
Dissertation Abstract

博士の専攻分野の名称　　博士（歯学）　　氏　名　矢　後　亮　太　朗

学　位　論　文　題　名

Color Science–Driven Approaches to Diagnosis and Prevention in Restorative Dentistry: Visibility of Recurrent Caries and Post-Bleaching Discoloration Control

（保存修復における色科学に基づく診断・予防アプローチ：ユニバーサルシェードによる二次う蝕の視認性と漂白後着色の制御）

Keywords: Recurrent caries, Caries detection, Universal shade resin composite, Fluoride varnish, Tooth bleaching

Color science plays a central role in contemporary restorative and esthetic dentistry, influencing both diagnostic accuracy and treatment longevity. This doctoral dissertation integrates two independent yet conceptually connected studies that explore the diagnostic and preventive potential of color-related phenomena in clinical dentistry. By focusing on the optical behavior of restorative materials and the color susceptibility of tooth structures, this work aims to establish a coherent framework for understanding how color science can contribute to early detection of disease and maintenance of esthetic outcomes.

Part I investigates whether recurrent caries beneath resin composite restorations can be visually detected through the material, with particular emphasis on universal-shade resin composites based on structural color. Through a series of in vitro experiments involving standardized artificial caries

models, the study examined instrumental color difference (ΔE_{00}) and visual detectability by dentists and lay observers. The findings demonstrated that structural-color-based composites such as Omnichroma transmit and reflect underlying chromatic information more readily than pigment-containing conventional composites, thereby enhancing the visibility of caries-simulating colors. These results suggest that the inherent optical properties of universal-shade composites may facilitate earlier recognition of recurrent caries by both clinicians and patients, supporting timely intervention.

Part II addresses a contrasting but complementary issue: the prevention of post-bleaching pigmentation. While bleaching effectively improves tooth brightness, the procedure temporarily increases enamel roughness and susceptibility to extrinsic discoloration. This study evaluated the capacity of fluoride varnishes to inhibit early staining immediately after bleaching. Both Clinpro White Varnish and Enamelast significantly reduced ΔE_{00} after exposure to coffee, and scanning electron microscopy revealed partial restoration of enamel surface morphology. These findings indicate that varnish application provides a physical barrier and promotes remineralization, thereby preserving whitening effects during the high-risk early period following bleaching.

Together, these studies illustrate how the principles of dental color science—optical transmission, color stability, material translucency, and surface–light interactions—can be harnessed for both diagnostic and preventive purposes. By situating restorative material optics and enamel susceptibility within a unified conceptual framework, this dissertation underscores the importance of integrating color-related knowledge across clinical domains. The results contribute to the development of materials and clinical protocols that enhance early detection of pathology and support long-term esthetic outcomes in restorative dentistry.