INTRA-ORAL TELEVISION MICROMEASUREMENT INSTRUMENTATION*†

A. I. KLEIN‡ and D. MACPHERSON§
Indiana University School of Dentistry, Indianapolis, Indiana 46202

Abstract—The paper describes the development, design and operation of a television microscopic instrumentation which was specifically constructed to measure intra-orally, under clinical conditions, the adaptation of the cavo-filling margin deterioration of restorations in primary teeth. Basically, the intra-oral television micromeasurement instrumentation is achieved by coupling a petrographic microscope to a two-camera closed-circuit television system through scan line measurement circuitry. A 1-mm dia. circular area of the cavo-filling margin can be serially viewed at 250 × magnification with linear measurement change as small as 2 μ noted. Movement of the patient, at these magnifications, is limited by the use of a permachon (electronic memory) tube, which retains the image during measurement.

1. INTRODUCTION

Intra-oral clinical dental research generally is conducted at the level of the naked eye or the limited magnification of a binocular loop. Bulky equipment and the low light levels of the oral cavity make higher magnification observations impossible and accurate measurements highly improbable. The coupling of specifically designed optical equipment, containing a high intensity light system with a modified closed circuit television, makes available instrumentation capable of clinical microscopic intra-oral observations at magnifications of 250 × and measurements within a 1-mm dia. circular area. Linear measurement changes of 2 μ are readily made with accurate calibration of the equipment.

Clinically, the practicing dentist frequently observes the marginal breakdown or deterioration of the cavo-filling junction, particularly in the amalgam restorations of primary teeth. CASTALDI (1962) observed 1009 Class I amalgam restorations and noted that proximal margin defects occurred frequently, especially at the distobuccal margin of the mandibular deciduous first molar. NADAL et al. (1961) noted that the severity of marginal failure of amalgam restorations increased as the residual mercury content of the restoration increased. Other investigators (NOONAN, 1949; BROWN, 1949; MAHLER, 1958) have studied Class II deciduous cavity preparation design in an effort to limit this marginal deterioration and fracture; however, many of these studies were accomplished as clinical observations or with the aid of models. Therefore, our objective was to develop instrumentation to serially observe and measure not only marginal deterioration changes, but also other tissue changes intra-orally.

A previous paper (KLEIN, 1963) develops the theory of operation and application of a closed-circuit television system to dental research. The clinical application and measurement photographs of the intra-oral instrumentation is demonstrated in Figs. 1 and 2, where one notes

---

* First received 16 May, 1966 and in revised form 17 July, 1966.
† This study was supported in part by United States Public Health Service Grant DE 01813 from the National Institute of Dental Research, National Institute of Health, Bethesda, Maryland.
‡ Assistant Professor of Pedodontics, Indiana University School of Dentistry.
§ Television Electronics Technician, Indiana University School of Dentistry.
that the observations and measurements are made through a 1-mm dia. circular opening in a cast gold overlay that accurately fits the tooth. This overlay makes it possible to make serial measurements of marginal deterioration at various periods of time, in the same area. The schematic block diagram of the instrumentation is noted in Fig. 3, and the following details the development and design considerations of the instrumentation.

2. MICROSCOPE SYSTEM

Basically, the optical system is a Leitz Petrographic microscope consisting of a monocular

![Diagram of Intraoral Microscope System](image)

**Fig. 3.** A schematic block diagram which illustrates the application and basic components of the intra-oral television micromeasurement instrumentation. The microscope views the restored margin of the tooth whose image is monitored by the viewing camera. The permachon camera is activated through the foot controlled shutter light system, to store the viewed image. Electronic micromeasurement of the restored tooth margin adaptation is accomplished through the measurement instrumentation composed of a line selector, marker generator, oscilloscope, special effects generator, and video mixer-switcher.