Adherence of *Streptococcus mutans* to Dextran Synthesized in the Presence of Extracellular Dextranucrase

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Live or heat-killed cells of *Streptococcus mutans* specifically adhere to dextran previously synthesized on glass surfaces by the action of extracellular dextranucrase.

Certain strains of *Streptococcus mutans* capable of synthesizing insoluble dextran appear to initiate the formation of dental plaque on smooth surfaces (8). Dextranucrase (EC 2.4.1.5.) from these strains catalyzes the formation of insoluble dextran from sucrose (4). This enzyme is primarily detected as an extracellular protein but has also been demonstrated in a cell-bound form (4). Recently, Mukasa and Slade (6) directly demonstrated that cell-bound dextranucrase can mediate the attachment of *S. mutans* to smooth surfaces. Previously, Gibbons and Fitzgerald (3) demonstrated that *S. mutans* could adhere to teeth coated with dextran synthesized by *Leuconostoc* ATCC 14935. This suggested that dextran synthesized on tooth surfaces by the action of the extracellular dextranucrase from *S. mutans* might also play a role in cellular adherence. This report demonstrates that *S. mutans* can specifically adhere to dextran formed on smooth surfaces by the action of the extracellular enzyme of the organism.

Human cariogenic *S. mutans* GS-5 and *S. salivarius* GS-15 were supplied by R. J. Gibbons, Harvard University Dental School. *S. mutans* strains HS-6, OMZ-176, FA-1 and *S. sanguis* 10556 were kindly supplied by H. D. Slade. All organisms were maintained and grown as previously described (5) except that *Bacillus stearothermophilus* was grown at 55 C. Dextran-coated glass surfaces were prepared by incubating 0.012 units of partially purified dextranucrase (0.12 units/mg) with 2% sucrose and saline-0.04% sodium azide (total volume 2.0 ml) in glass tubes (13 by 100 mm) inclined at a 30° angle. The enzyme was prepared after precipitation of the culture medium of *S. mutans* GS-5 with ammonium sulfate and passage of the enzyme through a Bio Gel A-15 column (2). After incubation for 18 h at 37 C, the tubes were decanted and gently washed three times with saline. Visual examination of the tubes revealed a thin film of dextran as noted previously (6). Glucose-grown cells (approximately $3 \times 10^8$ per tube), washed three times with saline and suspended in saline-sodium azide, were added to the dextran-coated tubes in a total volume of 2.0 ml. The tubes were again incubated for 18 h at 37 C at an inclined angle. Adhered cells were gently washed three times with saline and suspended vigorously in 3.0 ml of 0.5 NaOH, and the turbidity was determined at 540 nm (7).

When washed cell suspensions of *S. mutans* GS-5 were incubated with glass surface-coated dextran synthesized in the presence of the extracellular enzyme, significant cellular adherence was observed (Fig. 1). Celluar adherence was shown to be dependent on the prior incubation of the extracellular dextranucrase together with sucrose (Table 1). The omission of either component resulted in turbidity measurements.

![Absorbance vs. Cells](http://iai.asm.org/)

**FIG. 1.** Adherence of *S. mutans* GS-5 to dextran-coated glass surfaces as a function of cell concentration. Adherence assays were carried out as described in the text. Absorbance values have been corrected for blank tubes lacking sucrose. The cell suspension used contained approximately $2 \times 10^8$ cells per ml.
approximating that heat-killed thermore, 

\[
\begin{array}{c|c|c|c}
\text{Dextranucrase} & \text{Sucrose} & \text{Cells} & A_{140} \\
\hline
+ & + & + & 0.268 \\
- & + & + & 0.048 \\
Boiled\textsuperscript{\text{*}} & + & + & 0.056 \\
+ & - & + & 0.059 \\
+ & + & Boiled\textsuperscript{\text{*}} & 0.320 \\
\end{array}
\]

\textsuperscript{\text{*}} Adherence assays were carried out as described in the text.

\textsuperscript{\text{*}} Heated for 10 min at 100 C.

**TABLE 1. Requirements for cellular adherence**

**TABLE 2. Specificity of cellular adherence**

**LITERATURE CITED**


