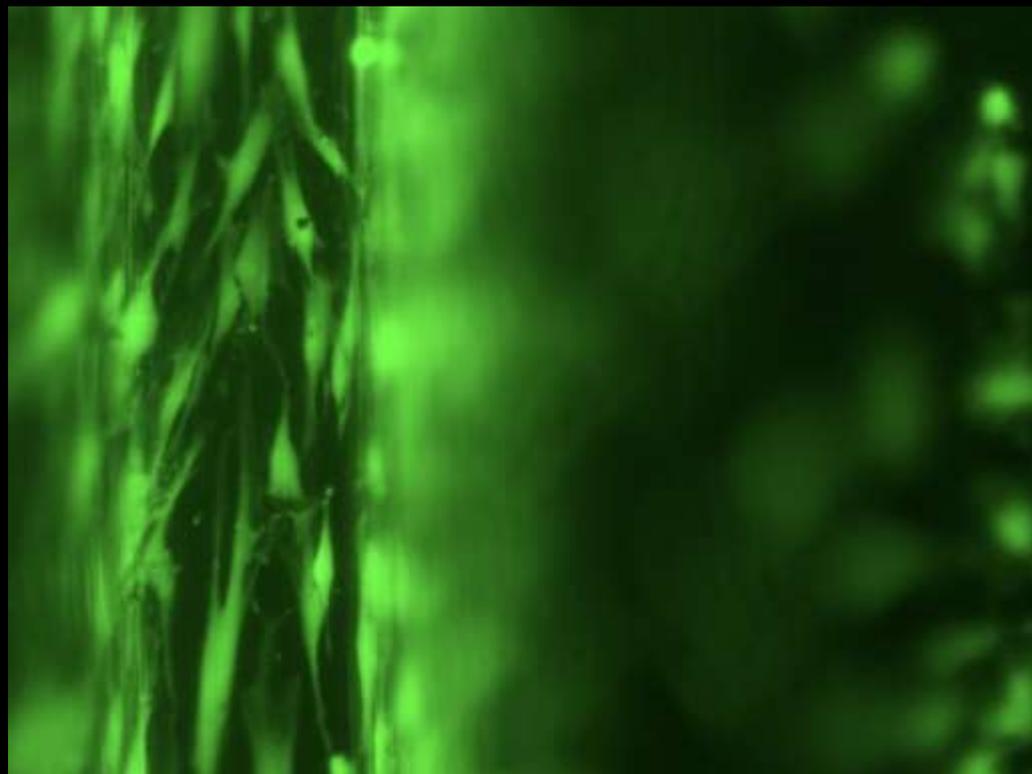


# The Effect of **Implant Surface Bioactivation** with PRGF on Cell Attachment in the Presence of Cigarette Smoke Extract



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## Effect on Periodontal Structures and Natural Teeth



- Increased incidence of periodontal disease (Bergström, 1991)
- Increased levels of periodontal pathogens (Haffajee and Socransky, 2001)
- Poor healing results (Tonetti, 1998)
- Poorer long term prognosis (Tonetti, 1998)

## Cigarette Smoking

## Effect on Dental Implants



- Implants in smokers 2.5x more likely to fail (Bain and Moy, 1993)
- Increased incidence of peri-implant mucositis and peri-implantitis (Renvert, 2015)

# How do Cigarettes Effect Dental Implant Success

**PATIENT LEVEL**

**CELLULAR LEVEL**

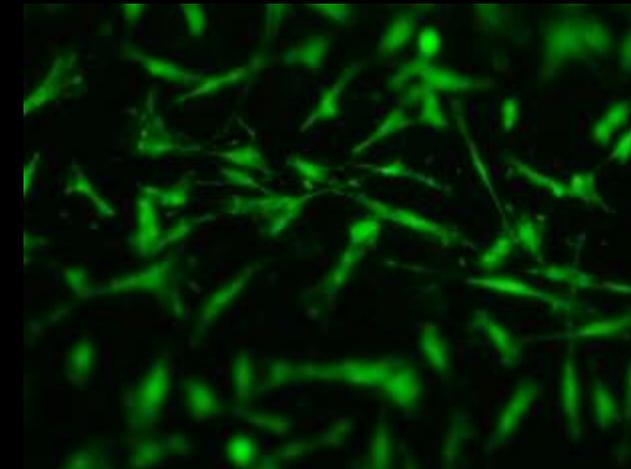
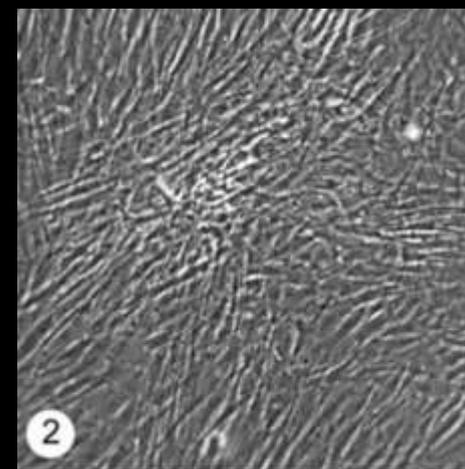
**SURGEON LEVEL**

# How Does Smoking Affect Cells?

# Cells Used in this Study

CELLULAR LEVEL

Human gingival fibroblasts obtained from 13 year old male patient at LSU



↓ PDL fibroblast attachment and differentiation

↓ Gingival fibroblast attachment and differentiation

↓ Osteoblast attachment and differentiation

## What is it?

CSE is a solution prepared by drawing the smoke from a lit cigarette through 10ml of MEM $\alpha$  media over 60 seconds

Used in research to mimic the effect of smoking on cells

## How was it used?

A dilution of 1.5% CSE solution was used in the current study.

This level reflects the salivary levels of CSE of resting saliva in an average smoker

### Cigarette Smoke Extract (CSE)



100% CSE

## What is it?

Coating a dental implant surface in a bioactive material in the hopes of improving the biological compatibility of the dental implant

## How is it achieved?

BMPs

PRGF, PRP, PRF

TGF

Peptides

Extracellular matrices

## Implant Surface Bioactivation



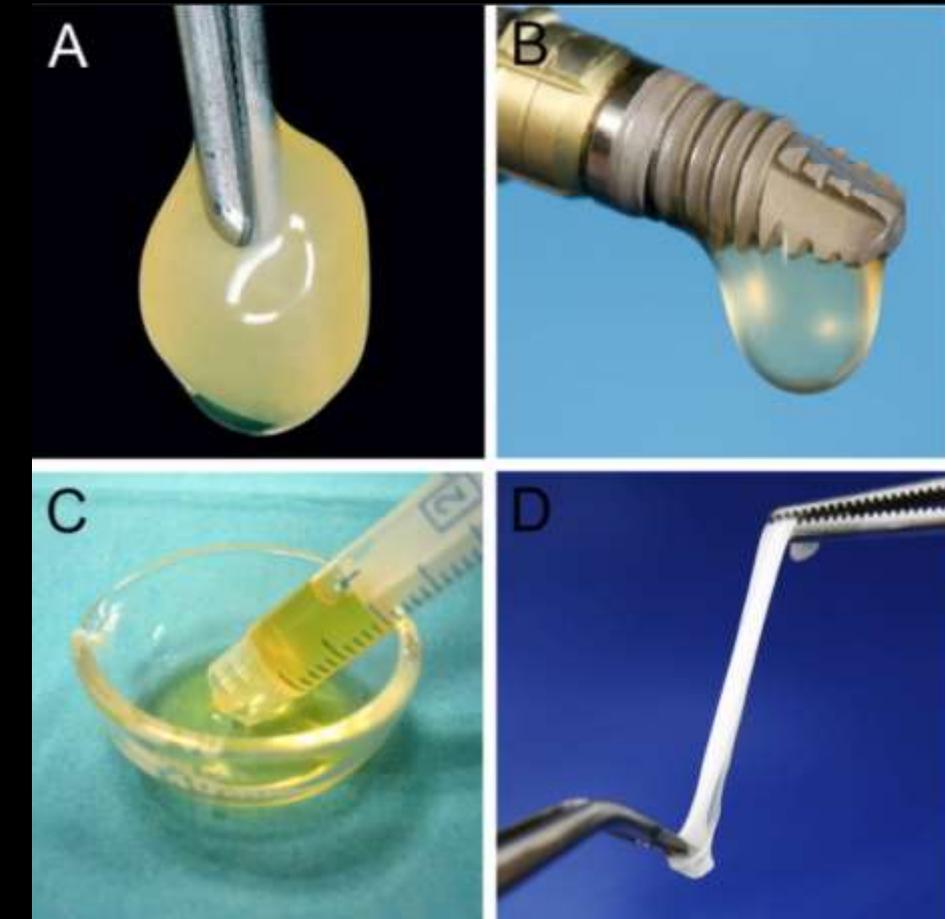
## Plasma Rich in Growth Factors

100% Autologous pure platelet-rich plasma (P-PRP) product

Does not contain leukocytes - avoiding their pro-inflammatory activity

PRGF releases growth factors and proteins that are involved in wound healing

- Platelet derived growth factor (PDGF)
- Insulin like growth factor (IGF)
- Transforming growth factor  $\beta$  (TGF- $\beta$ )
- Vascular endothelial growth factor (VEGF)



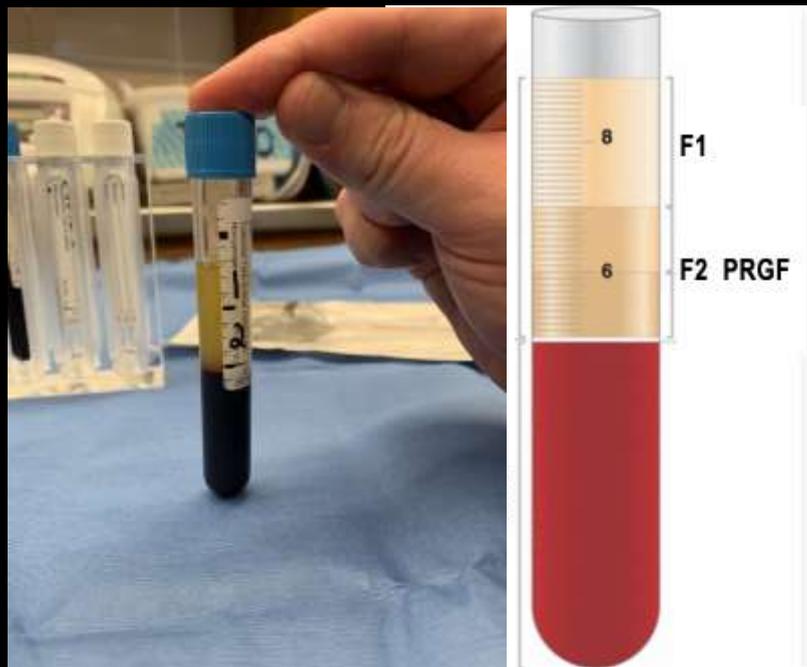
Blood Draw



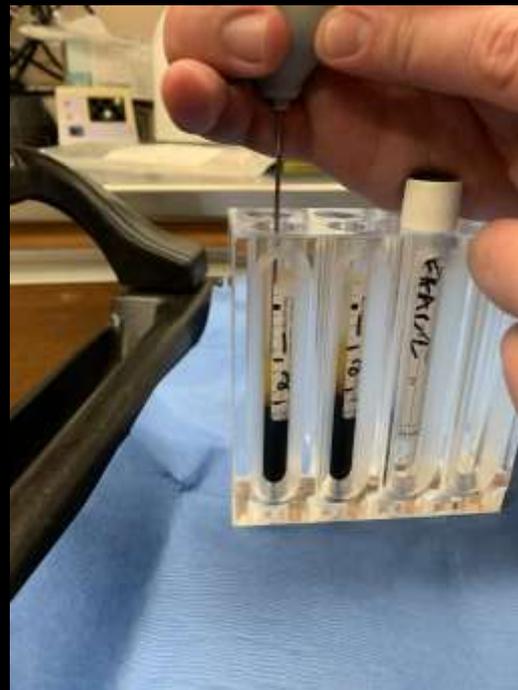
# PRGF Preparation



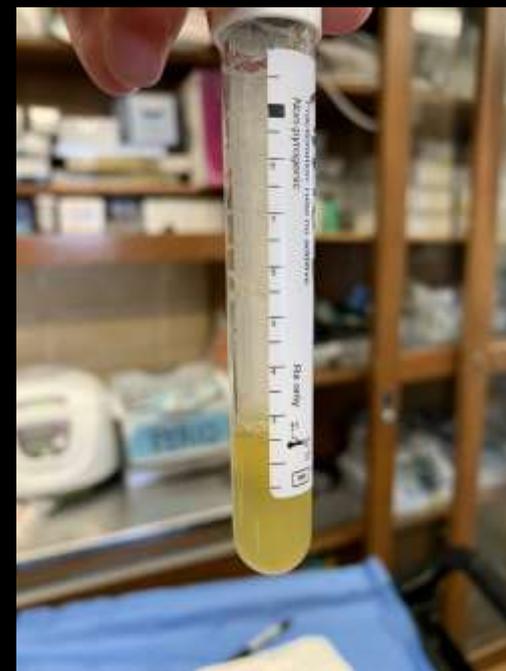
Centrifuge for 8 mins



After centrifugation



Collect fractions



Fraction 2=PRGF



Implant placed  
in PRGF  
for 5 mins

# Current Study Objectives

**Purpose:** This study was designed to examine the effect of implant surface bioactivation with PRGF in the presence of CSE on the attachment of gingival fibroblasts to four different dental implant surfaces

**Hypothesis:** Surface bioactivation of dental implants with PRGF will enhance the attachment of gingival fibroblasts to the dental implant surface in the presence of CSE.

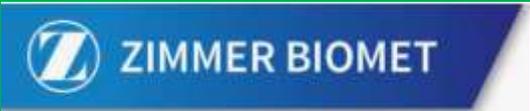
# Study Design

## Implant Brands Used

Surface 1:  Osseotite

Surface 2:  TiUnite

Surface 3:  SLA

Surface 4:  MTX

## Phase 1: +/- PRGF

Control: Uncoated Implants (n=4 per surface)

Test: Implants coated in PRGF (n=4 per surface)

## Phase 2: +/- PRGF in the presence of CSE

Control: Uncoated Implants in presence of CSE  
(n=4 per surface)

Test: Implants coated in PRGF in presence of CSE  
(n=4 per surface)

# Study Methods



PRGF Group soaked for 5 mins



-Gingival fibroblasts, CSE and dental implants plated  
-Placed in fresh well at 24 hours and incubated for 48 hours



-Cells frozen  
-Cells vortexed to release RNA  
-Cy-QUANT fluorescent dye added



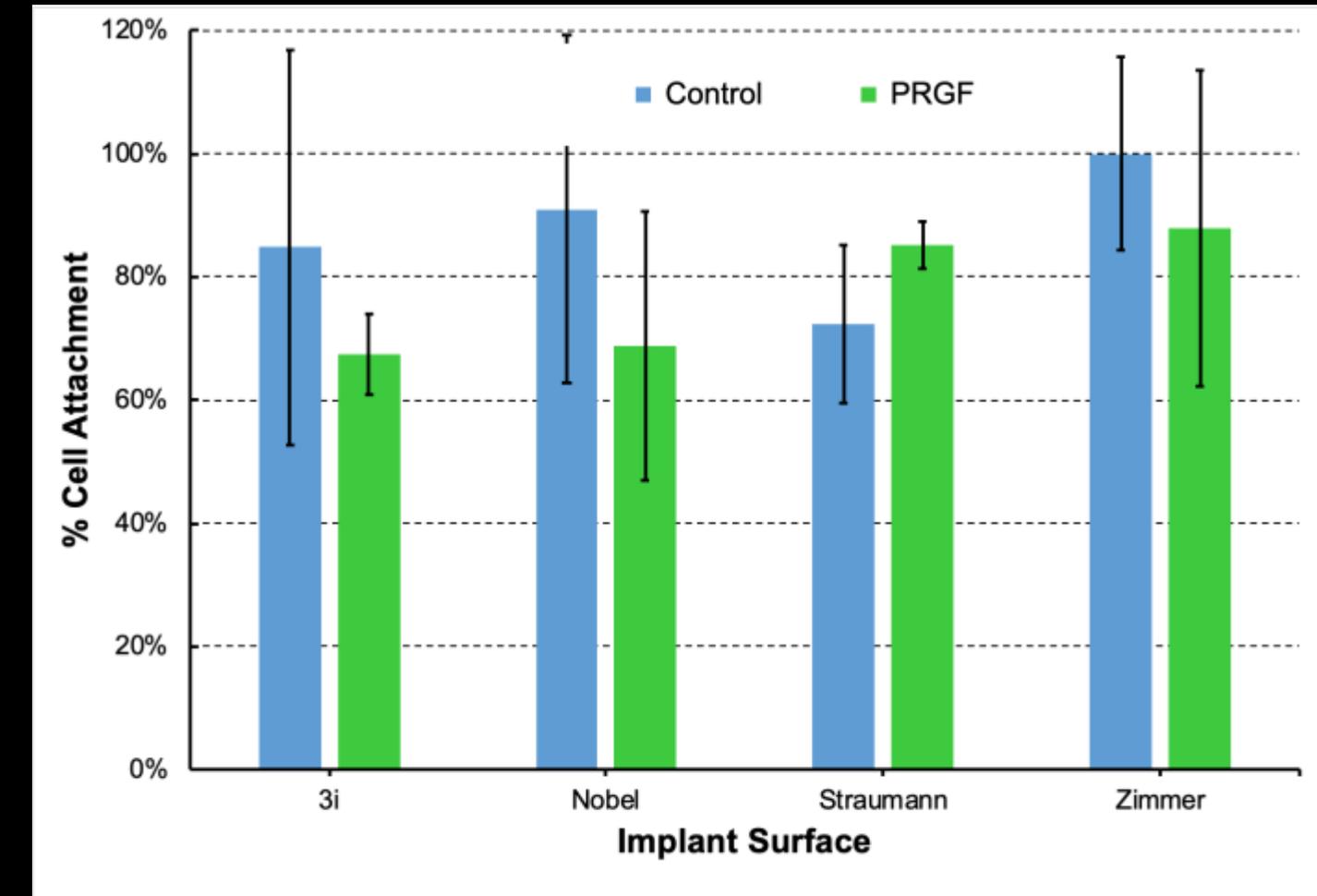
Fluorescence Microplate Reader used to quantify cellular attachment

# RESULTS

## Phase I: Cell Attachment to dental implants with and without PRGF Surface Bioactivation

Implant Surface	Mean Cellular Attachment	
	Control Group (SD)	PRGF Group (SD)
3i	26,908 ( $\pm 10,873.9$ )	21,610 ( $\pm 3,126.03$ )
Nobel	28,768 ( $\pm 9,708.53$ )	22,032 ( $\pm 7,800.79$ )
Straumann	23,106 ( $\pm 5,047.50$ )	26,983 ( $\pm 2,318.63$ )
Zimmer	31,509 ( $\pm 8,938.61$ )	27,859 ( $\pm 8,938.61$ )

\*\*NSSD between implant brands in either group

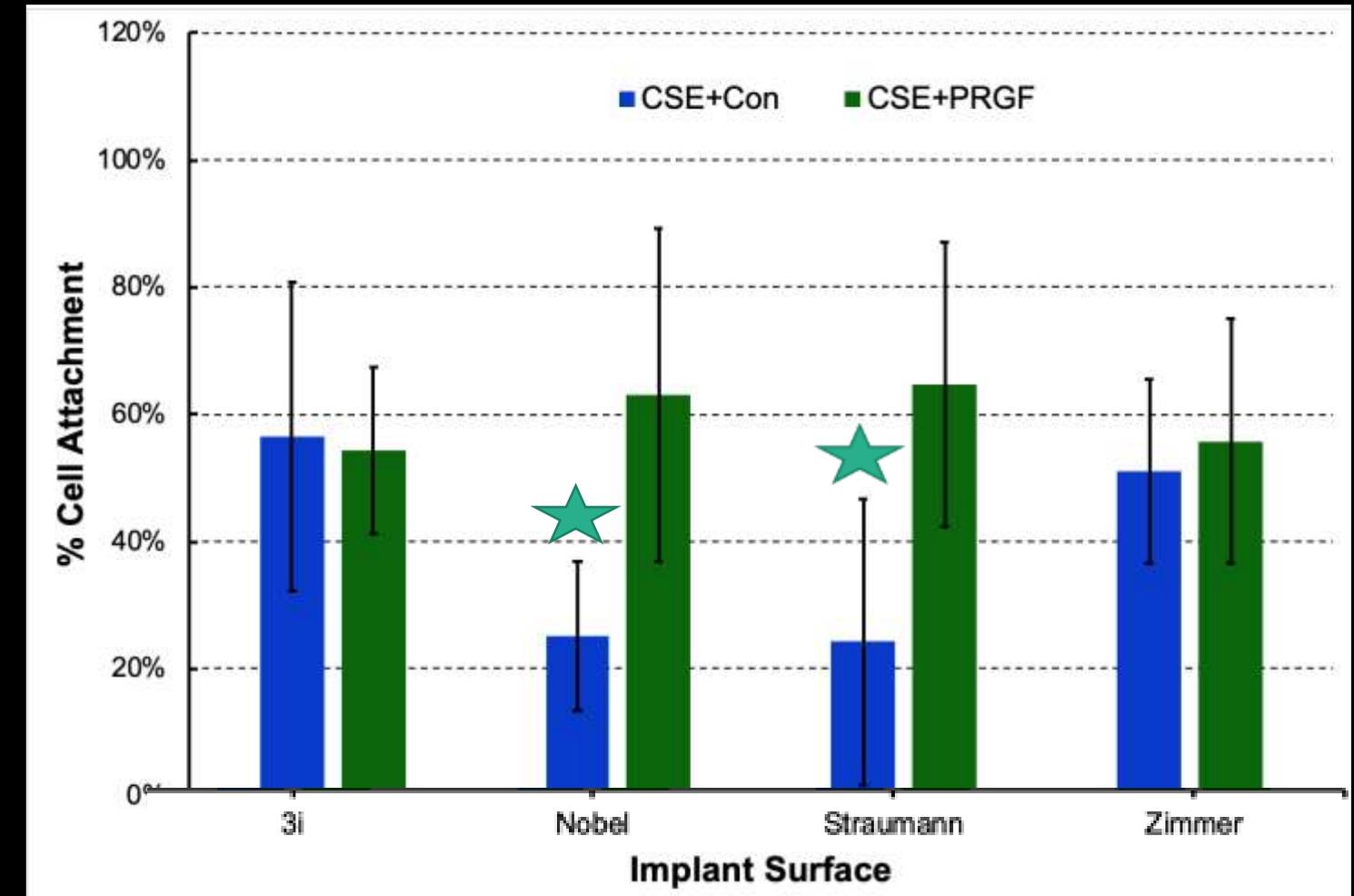


# RESULTS

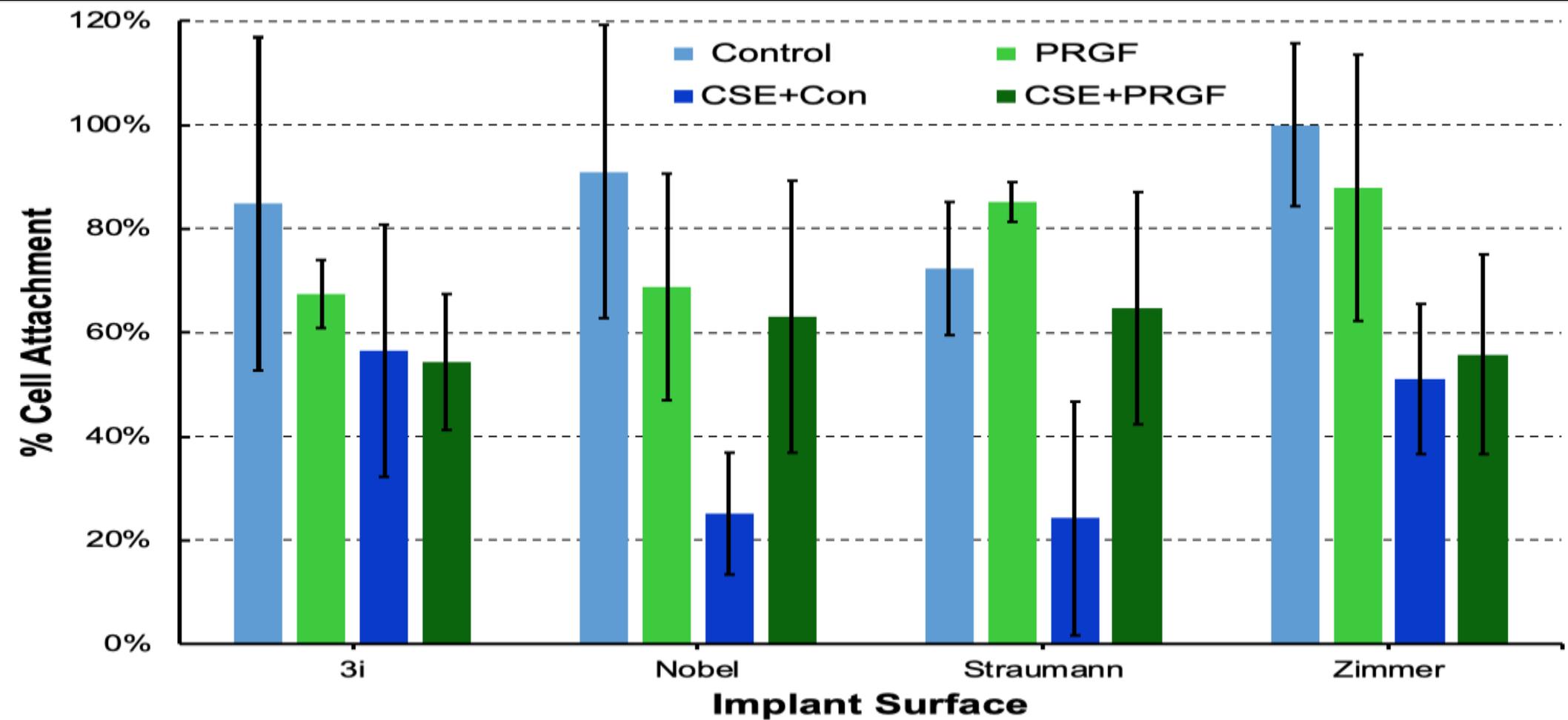
## Phase II: Cell Attachment to dental implants with and without PRGF Surface Bioactivation in the Presence of CSE

Implant Surface	Mean Cellular Attachment	
	CSE Alone Group (SD)	CSE + PRGF Group (SD)
3i	12,034 ( $\pm$ 3,624.77)	11,594 ( $\pm$ 2,321.38)
Nobel	5,872 ( $\pm$ 1,506.55)	13,319 ( $\pm$ 4,159.53)
Straumann	5,682 ( $\pm$ 1,999.37)	13,662 ( $\pm$ 3,773.63)
Zimmer	10,968 ( $\pm$ 2,374.82)	11,890 ( $\pm$ 3,036.68)

\*\*SS reduction in cellular attachment to Nobel and Straumann implants in the presence of CSE, PRGF helped rescue this reduction



# RESULTS

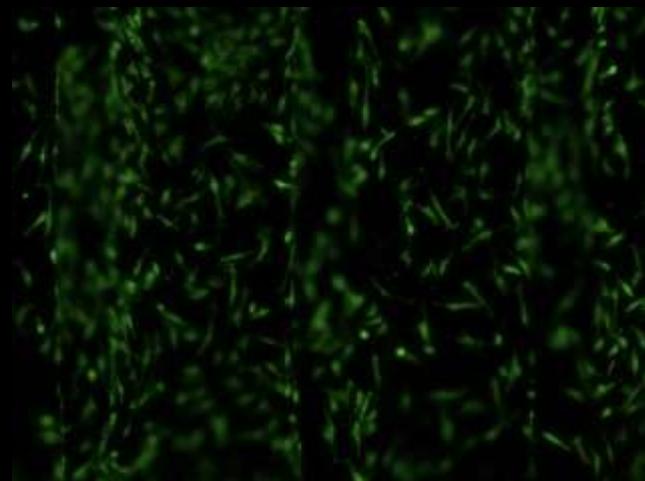


**\*\*The addition of PRGF in the presence of CSE lead to a SS increase in attachment of gingival fibroblasts to Nobel and Straumann Implants**

# RESULTS



Control



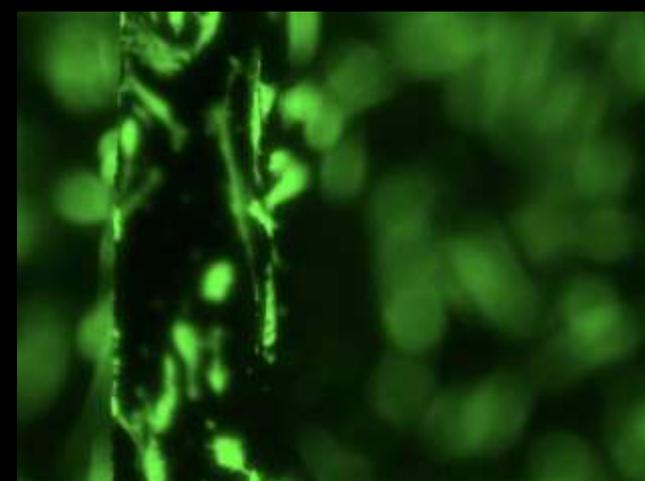
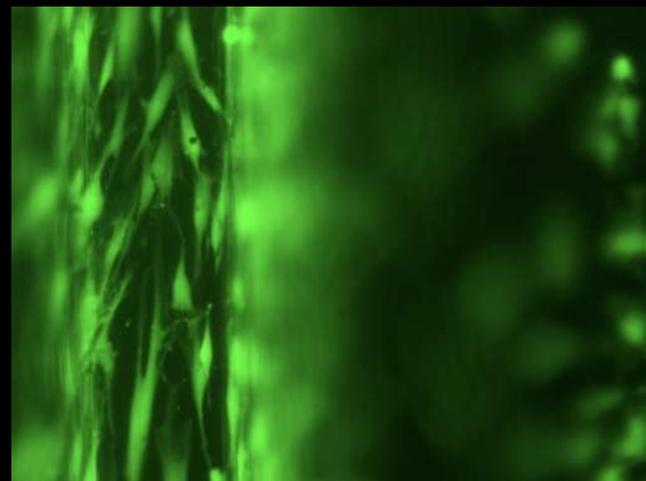
PRGF



CSE



CSE + PRGF



# CONCLUSIONS

This study demonstrated that in the presence of cigarette smoke extract; the overall attachment of gingival fibroblasts was reduced to various implant surfaces.

When implants were placed in PRGF for 5 minutes prior to cell exposure, this reduction in cellular attachment was corrected.

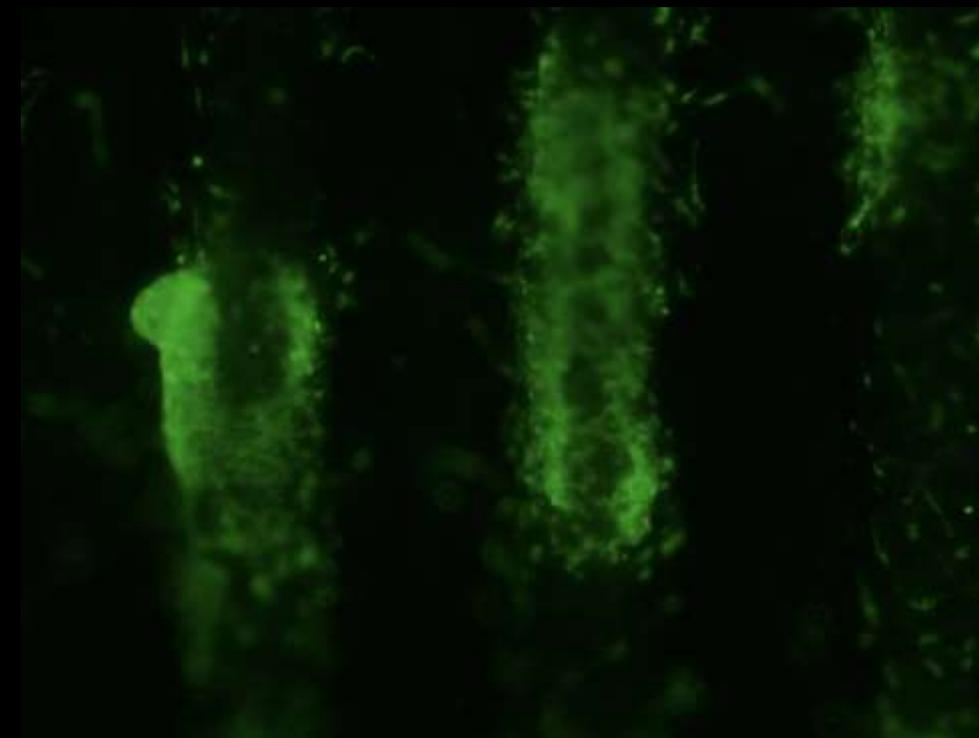
Within the limitations of this study, this provides a proof of concept for additional, large-scale studies to evaluate the true efficacy of implant surface bioactivation with PRGF.

# FUTURE RESEARCH



Larger studies are needed to evaluate the true impact of PRGF surface bioactivation on cellular attachment, including evaluation of PDL fibroblasts and osteoblasts

Future clinical studies for implant survival and incidence of peri-implant diseases



THANK YOU



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