

INTRODUCTION:

AIM:

To evaluate and compare the antimicrobial effect of chlorhexidine gel and novel herbal gel containing tea tree oil, peppermint oil and aloe vera on peri-implantitis pathogens.

RATIONALE:

- **Peri-implantitis** is a polymicrobial infection that causes inflammation of the peri-implant tissues leading to progressive damage of supporting bone.
- **Chlorhexidine gluconate** is a commonly prescribed antimicrobial therapy.
- **Disadvantages:** Tooth discolouration, mucosal burning, allergic reaction, growing resistance and impaired oral microflora.
- Hence, there is a thirst for alternative agents, and the focus has shifted toward herbal compounds.

METHOD:

- **Minimum inhibitory concentration, Minimum bactericidal concentration**
- **Cytotoxicity assay** using mouse fibroblast L929
- **Herbal gel formulation**
- **Antimicrobial efficacy:** Using disk-diffusion agar method against organisms *Porphyromonas gingivalis* (ATCC 33277) and *Staphylococcus aureus* (ATCC 25923).
- A total of 40 titanium discs (Grade IV, ASTM : B348) subdivided into 2 groups: **Group A** (2% formulated herbal gel) and **Group B** (1% chlorhexidine gel).
- **Statistical analysis:** One-way ANOVA and Mann Whitney U test, $p \leq 0.05$.



Composition of Formulation Gel

Gel Formulation	Percentage
Tea tree oil (IP Grade)	0.4% W/W
Peppermint oil (IP Grade)	0.4% W/W
Carbopol 934	0.1% W/W
Span 60	2.0% W/W
Span 20	1.0% W/W
Tween 80	1.0% W/W
Aloevera (Aloe barbadensis miller)	1.0% W/W
Glycerin	5% W/W
Methyl Paraben	0.01% W/W
Sodium Benzoate	0.5% W/W
Water – 9S	100% W/W

RESULTS:

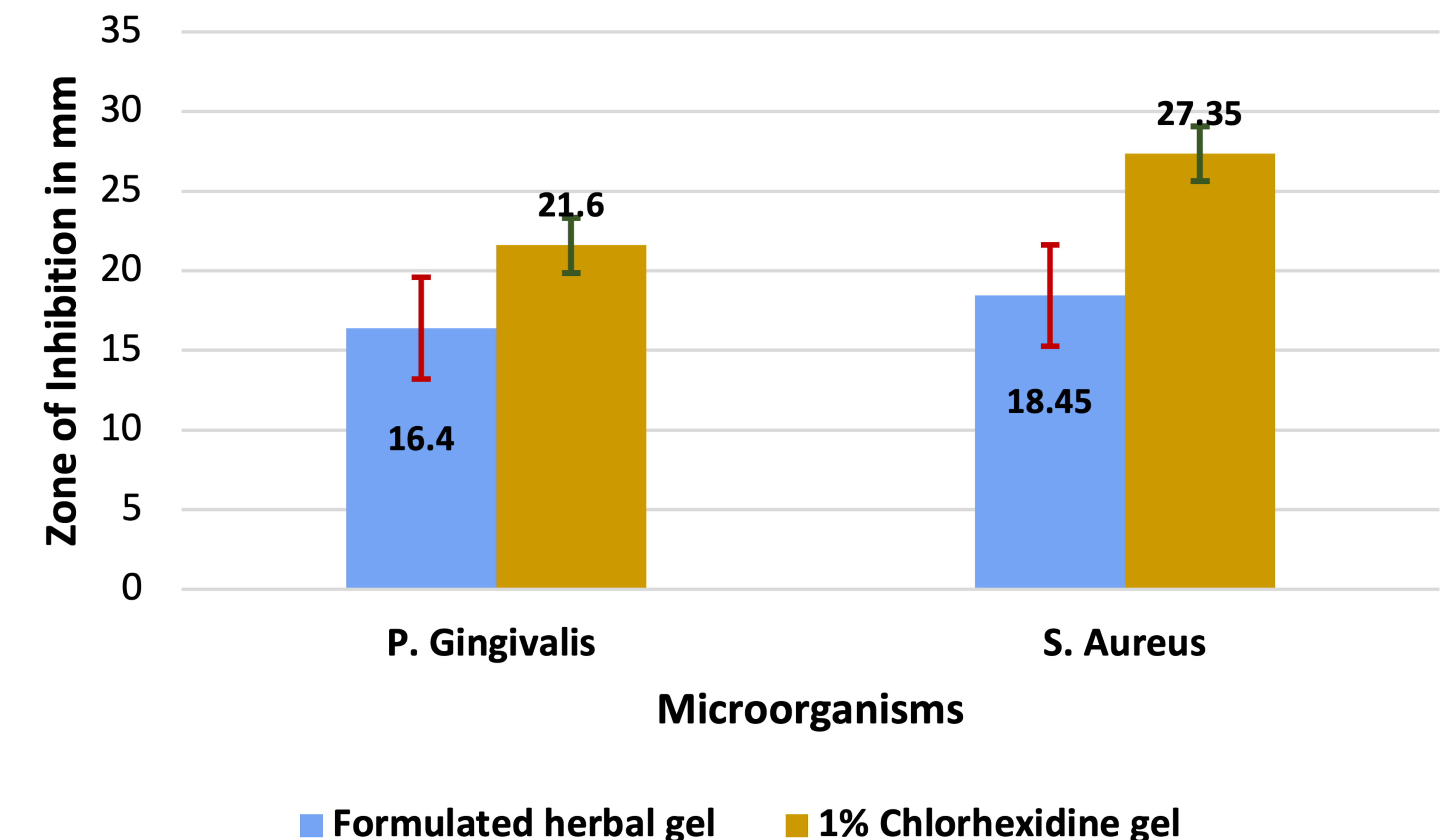
- **Cytotoxicity assay : Favorable cell viability of 92.12%.**
- Minimum inhibitory concentration and minimum bactericidal concentration, indicated a **synergistic effect of tea tree oil and peppermint oil**, and revealed a prolonged antimicrobial efficacy against *S. aureus* at a 48-hour interval compared to the individually tested components.
- Group B (1% chlorhexidine gel) exhibited a larger zone of inhibition than Group A (2% herbal gel). The mean zone of inhibition seen with 1% chlorhexidine gel for organism **P. Gingivalis** was 21.60 ± 3.185 mm, and with 2% herbal gel was 16.40 ± 1.729 mm. Whereas with organism **S. Aureus**, chlorhexidine gel showed a mean zone of inhibition of 27.35 ± 1.137 mm and 18.45 ± 1.099 mm with the herbal gel. The difference between the groups was statistically significant, at the level of significance of $p < 0.01$.

Comparison of Minimum Inhibitory Concentration values (MIC) & Minimum Bacterial Concentration values (MBC) (%)

SA=Staphylococcus aureus, PG=Porphyromonas gingivalis,
**One way ANOVA test *Statistically significant $p \leq 0.05$*

Samples	Minimum inhibitory concentrations (MIC)				Minimum bactericidal concentration (MBC)			
	PG	SA	F	Sig. p value	PG	SA	F	Sig. p value
Essential oil								
Tea tree oil	0.5	0.25	3.796	0.151	1	0.5	3	0.192
Peppermint oil	0.5	0.5			1	1		
Synergistic oil	0.25	0.125			0.5	0.25		

Mean value and standard deviation of formulation zone of inhibition against microorganisms



Antimicrobial Efficacy of Chlorhexidine Gel and Novel Herbal Gel Containing Tea Tree Oil, Peppermint Oil and Aloe Vera against Peri-implantitis Pathogens

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DISCUSSION:

- Attention on natural extract has been increasing in the oral-health field.
- Essential oils have demonstrated antimicrobial activity against peri-implant pathogens.
- Moreover, aloe vera has potent antibacterial property and has shown to inhibit the inflammatory process, indicated by reduced myeloperoxidase levels, leukocyte adhesion and pro-inflammatory cytokines.
- Therefore, the herbal gel was formulated using aloe vera extract, and the synergistic effect of peppermint oil on the efficacy of australian tea tree oil. The prepared gel was compared to the gold standard, 1% chlorhexidine gel, to determine its efficacy in the treatment of peri-implantitis.

CONCLUSION:

Within the limitations of this study, the formulated herbal gel exhibited antibacterial efficacy comparable to that of 1% chlorhexidine gel, showed favorable cell viability, and may serve as an alternative for management of peri-implantitis.

FURTHER SCOPE OF THE STUDY:

Since this was an In-vitro study, further In-vivo studies are required to validate the preliminary findings and establish a foundation for treatment of peri-implantitis. The efficacy of the gel against other peri-implant pathogens should also be assessed.

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