



Assessment Of Peri-Implant Soft & Hard Tissue In Micro Threaded Implants Vs Double Threaded Implants: A Comparative Clinico- Radiographic Study

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Abstract: Background: Implant design features may influence peri-implant tissue response and long-term success.

Aim: To compare peri-implant soft and hard tissue changes between micro-threaded implants with a coronal cutting flute (NeO) and double-threaded implants without cutting flutes (SPI).

Materials and Methods: Ten subjects were randomly allocated into two groups. Clinical parameters (PI, GI, mSBI, PPD) and radiographic crestal bone levels were assessed at baseline and 3 months.

Results: Both groups showed improvement in clinical parameters and acceptable crestal bone loss. No statistically significant intergroup differences were observed ($p > 0.05$).

Conclusion: Both implant systems demonstrated comparable short-term peri-implant tissue responses.

Keywords: Dental implants, crestal bone loss, peri-implant tissues, implant design

Introduction

Contemporary dentistry aims to restore optimal function, esthetics, comfort, phonetics, and occlusal harmony; however, tooth loss remains inevitable in certain clinical conditions, leading to compromised oral function and reduced quality of life^{1,2,3}. Dental implants have emerged as a predictable and reliable modality for the rehabilitation of edentulous spaces, owing to their ability to achieve direct bone-to-implant contact and high long-term success rates^{4,5}. The classical two-stage surgical protocol facilitates undisturbed healing and minimizes complications, thereby promoting successful osseointegration⁴. Nevertheless, implants differ biologically from natural teeth, lacking periodontal ligament and exhibiting altered soft tissue attachment, which increases their susceptibility to peri-implant inflammation and crestal bone loss^{5,6,7}. Marginal bone loss, particularly during the early healing phase, is a critical determinant of implant prognosis and is influenced by multiple factors, including implant design, surface characteristics, and biomechanical loading^{7,8,9}. While clinical and radiographic parameters are essential for evaluating peri-implant health, limited evidence exists regarding the influence of implant macrodesign features such as cutting flute configuration on tissue response and primary stability^{10,11}. Therefore, the present study aims to comparatively evaluate the hard and soft tissue responses around micro-threaded implants with a coronal cutting flute design and those without cutting flutes.

Aim and Objectives

This study aimed to compare peri-implant hard and soft tissue responses between micro-threaded implants with a coronal cutting flute design and those without cutting flutes. Clinical and radiographic parameters were used to assess peri-implant tissue changes in both groups. The outcomes were analyzed to determine differences in tissue response between the two implant designs.

Materials and Methods

A prospective randomized controlled clinical trial was conducted on 10 subjects (18–45 years) to compare peri-implant tissue responses between Alpha Bio SPI and Alpha Bio NeO implant systems, following ethical approval and informed consent. (IEC N0. EC244198).

Participants meeting predefined inclusion criteria were randomly allocated into two groups. Preoperative assessment included clinical examination and radiographic evaluation (OPG and CBCT), and surgical stents were fabricated. Implants were placed under aseptic conditions using a standardized two-stage protocol with postoperative care, followed by prosthetic rehabilitation after 4 months. Clinical parameters (PI, GI, mSBI, and PPD) and radiographic crestal bone levels were assessed at baseline and 3 months to evaluate peri-implant hard and soft tissue changes.

Statistical Analysis

Data were analyzed using SPSS version 21.0 (IBM, Chicago). Descriptive statistics included mean and standard deviation. Intragroup comparisons were performed using paired t-test, while intergroup comparisons were analyzed using independent t-test. A p-value <0.05 was considered statistically significant.

Results

A total of 10 implants (n=5 per group) were evaluated for peri-implant hard and soft tissue changes over 3 months. Both groups demonstrated improvement in clinical parameters, with a statistically significant reduction in plaque index in both groups and gingival index in the SPI group, while changes in mSBI and probing depth were not significant. Radiographically, both groups showed significant crestal bone loss within acceptable limits (SPI: 0.26 mm; NeO: 0.37 mm). However, intergroup comparison revealed no statistically significant differences in any clinical or radiographic parameter, indicating comparable short-term performance of both implant systems.

Table 1: Intragroup comparison of Plaque Index, Gingival Index, and Bleeding Index at baseline and 3 months (SPI group)

Parameter	Site	Baseline (Mean ± SD)	3 Months (Mean ± SD)	Mean Difference	t-value	P-value
Plaque Index	Implant site	0.536 ± 0.045	0.387 ± 0.024	0.1492	7.657	0.042*
	Full mouth	0.638 ± 0.568	0.510 ± 0.059	0.1276	15.957	0.639NS
Gingival Index	Implant site	0.599 ± 0.119	0.456 ± 0.034	0.1430	10.120	0.02*
	Full mouth	0.595 ± 0.039	0.490 ± 0.077	0.1051	4.399	0.218NS
Bleeding Index	Implant site	0.599 ± 0.559	0.479 ± 0.087	0.1204	6.875	0.385NS

	Full mouth	0.632 ± 0.060	0.500 ± 0.084	0.1321	9.697	0.914NS
Peri-implant Probing Depth (mm)	Implant site	3.00 ± 0.010	3.80 ± 0.44	0.8000	4.812	0.161NS
Crestal Bone Height (mm)	Implant site	13.77 ± 1.67	13.51 ± 1.66	-0.2604	17.835	0.013*

Statistically significant (P < 0.05); NS: Not significant (P > 0.05)

Table 2: Intragroup comparison of clinical and radiographic parameters at baseline and 3 months (NeO group)

*Statistically significant (P < 0.05); NS: Not significant (P > 0.05)

Parameter	Site	Baseline (Mean ± SD)	3 Months (Mean ± SD)	Mean Difference	t-value	P-value
Plaque Index	Implant site	0.492 ± 0.011	0.286 ± 0.021	0.2062	4.397	0.034*
	Full mouth	0.646 ± 0.507	0.507 ± 0.037	0.1392	3.799	0.719NS
Gingival Index	Implant site	0.594 ± 0.137	0.411 ± 0.380	0.1836	7.253	0.501NS
	Full mouth	0.567 ± 0.809	0.453 ± 0.092	0.1141	2.593	0.327NS
Bleeding Index	Implant site	0.604 ± 0.055	0.379 ± 0.093	0.2253	3.690	0.362NS
	Full mouth	0.636 ± 0.032	0.489 ± 0.019	0.1477	4.869	0.900NS
Peri-implant Probing Depth (mm)	Implant site	2.80 ± 0.44	3.40 ± 0.54	0.6002	3.580	0.148NS
Crestal Bone Height (mm)	Implant site	16.81 ± 0.54	16.44 ± 0.53	-0.3702	5.072	0.032*

Table 3:

Intergroup comparison of clinical and radiographic parameters between SPI and NeO groups at baseline and 3 months

Parameter	Group	Baseline (Mean ± SD)	3 Months (Mean ± SD)	Mean Difference	t-value	P-value
Plaque Index	Alpha Bio SPI	0.536 ± 0.045	0.387 ± 0.024	0.1492	6.307	0.626NS
	Alpha Bio NeO	0.492 ± 0.011	0.286 ± 0.021	0.2062		
Gingival Index	Alpha Bio SPI	0.599 ± 0.119	0.456 ± 0.034	0.1430	4.071	0.268NS

	Alpha Bio NeO	0.594 ± 0.137	0.411 ± 0.380	0.1836		
Bleeding Index	Alpha Bio SPI	0.599 ± 0.559	0.479 ± 0.087	0.1204	3.029	0.738NS
	Alpha Bio NeO	0.604 ± 0.055	0.379 ± 0.093	0.2253		
Peri- implant Probing Depth (mm)	Alpha Bio SPI	3.00 ± 0.010	3.80 ± 0.44	0.8000	2.070	0.485NS
	Alpha Bio NeO	2.80 ± 0.44	3.40 ± 0.54	0.6002		
Crestal Bone Height (mm)	Alpha Bio SPI	13.77 ± 1.67	13.51 ± 1.66	-0.2604	5.300	0.278NS
	Alpha Bio NeO	16.81 ± 0.54	16.44 ± 0.53	-0.3702		

NS: Not statistically significant (P > 0.05)

Discussion

The aim of contemporary dentistry is to restore oral health predictably. For partially or fully edentulous patients, traditional removable prostheses may not effectively restore normal function, aesthetics, speech, or comfort^{1,12,13}. Replacing teeth without harming adjacent dentition has long been a challenge for the dental profession. Branemark's introduction of osseointegration principles has revolutionized dentistry, allowing predictable restorations of fully and partially edentulous patients using implants^{14,15,16}. Since then, various implant designs and modifications have been developed to achieve better osseointegration and long-term stability^{17,18}. The present study evaluated peri-implant hard and soft tissue responses around micro-threaded implants with a coronal cutting flute (NeO) and double-threaded implants without cutting flutes (SPI). Both groups demonstrated improvements in plaque, gingival, and bleeding indices over the 3-month period, although most changes were not statistically significant. A slight, non-significant increase in probing depth was observed, likely due to early soft tissue remodeling.

Radiographically, both implant systems exhibited significant crestal bone loss; however, the values remained within acceptable limits for early healing. Intergroup comparison revealed no statistically significant differences in clinical or radiographic outcomes, indicating that both implant designs show comparable short-term peri-implant tissue responses^{19,20}.

Limitations

The present study is limited by a small sample size and short follow-up duration, which may affect the generalizability of the results. Additionally, implant-related variables such as length and diameter were not evaluated.

Further long-term, large-scale prospective studies are recommended to better understand the influence of implant design on peri-implant tissue dynamics and to validate the present findings.

Conclusion:

The present study evaluated peri-implant soft and hard tissue changes around micro-threaded implants with a coronal cutting flute (Alpha NeO) and double-threaded implants without cutting flutes (Alpha SPI) over a 3-month period following abutment placement. Both groups showed improvement in soft tissue indices and clinically acceptable changes in probing depth and crestal bone levels. Intergroup

comparison revealed no statistically significant differences, indicating comparable short-term peri-implant tissue responses between the two implant systems.

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