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IL-10 A/G rs1800896 and TNF-α G308A rs1800629 Polymorphisms and Their Relationship with the Risk of Implant Loss in Adult Patients from Argentina

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ABSTRACT

Introduction: the results of treatment in implantology have been evaluated mainly as implant survival rates in small groups of patients selected from specialized clinical or university settings. There is evidence to support polymorphisms that could be linked to some biological complications in implantology. The results may vary according to the origin or ethnic mixtures of the population studied. The objective of this study was to analyze the relationship between the polymorphisms IL-10 A/G rs1800896 and TNF-α G308A rs1800629308 and the loss of dental implants and periodontal disease. Material and method: 140 patients were selected, 10 with implant losses within a maximum period of 6 months of their placement. Each patient voluntarily consented to participate in the study (approved by CIEIS Adult Hospital Córdoba) Filiatory and clinical data were collected in a clinical history. Samples of clinically healthy oral mucosa were obtained and genotyped by PCR and RFPL. Results: The population consisted of male and female individuals in similar proportions (p=0.6121). The average age was 53.06±16.22 years, and an age variation range of 20 to 80 years. 7.7% of the patients included in the study had loss of their implant. It was observed that 62.5% of the patients who presented loss of implants were women. Of the patients with missing implants, 75% were smokers and did not consume alcohol. On the other hand, in relation to periodontal disease only 31% presented disease. In relation to genotype, patients with lost implants had 50% of the mutated allele of the SNP TNFα rs1800629, while 50% of patients with periodontal disease were carriers of the mutated allele for SNP IL-10 rs1800896. On the other hand, considering the total population under study, 31.06% of the patients presented the genotypes with the genetic variation, AG+GG, of the IL10 rs1800896 gene; while 64.07% presented the AA and GA genotypes, (both with the mutated allele) of the TNF-α G308A rs1800629 gene. No significant association (p=0.3298) was observed between IL10 rs1800896 genotypes and periodontal disease; contrary to whether there was a significant relationship of this SNP with periodontal disease (p=0.0164). Conclusion: The polymorphisms evaluated were not predictive of the failure of dental implants. However, a significant association between periodontal disease and TNF-α rs1800629 genotype could be observed. It is noteworthy that this is the first study that describes the frequency of the SNPs studied in a population of Córdoba–Argentina.

Keywords: biological complication, genetic markers, dental implant, polymorphism.

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I. Introduction

Currently rehabilitating with dental implants is described as the alternative treatment with success greater than 90% with respect to other options (fixed dental prosthesis, removable prosthesis). [1] The treatment named is predictable but not without complications, such as peri-implant mucositis (19–65%), peri-implantitis (1–47%) [2], aesthetic failures and complete loss of osseointegration before functional load. [3]. There is a statistically significant correlation between incidents of implant failure and tobacco use, diabetes, heart disease, poor oral hygiene, previous infection, poor bone quality and bruxism. A higher (statistically significant) incident rate was also observed in conical implants (by length, diameter, and location), internal connection, grade IV titanium, narrow and short implants. [4-6]. The presence of removable temporary prosthesis is associated with an increased risk of implant failure. In contrast, antibiotic coverage (before and after surgery and implants from certain manufacturers) were associated with a lower risk of implant failure [7]. Osteoporosis, Crohn's disease, proximity to the natural dentition is also associated with early implant failure ($p<0.05$) [8]. Other authors reported that smoking, being male, or total edentulism,

implant diameter, and bone augmentation surgery were associated with early implant failure. [9]. We found evidence that would support the relationship of polymorphisms with biological complications in implantology and the results may vary according to the ethnicity of the population studied. Inflammation has a critical effect on osseointegration and the success or failure of the implant, since if it persists in time it leads to bone loss resulting in implant failure.

By convention, a polymorphism is a difference in DNA sequence that occurs in ≥1% of the population. About 1–2% of the human genome contains sequences of genes that encode proteins, most polymorphisms will not directly affect gene activity. A polymorphism is a genetic variant in the DNA sequence between individuals of the same species and that is found with a frequency greater than 1% (below this, we call it mutation). A polymorphism may have no effect because it is in a non-coding region of DNA, but if we find the polymorphism in a coding or regulatory region, then the presence of the polymorphism is likely to have consequences on the phenotype. For example, it could make the allele of a drug metabolism gene nonfunctional. Polymorphism is one of the elements of genetic diversity that often responds to the need for adaptation to a given environment. The variety of blood groups (A, B, AB, and O) is an example.

The identification of polymorphic variants that could be related to the loss of implants will allow the development of a preventive intervention protocol. In some sociocultural contexts, an alternative to stop or reduce the incidence of IP in the population. These methodologies should be applied more rigorously to patients with other risk factors. Most published research on polymorphisms is initial studies with small sample sizes and uses different methods of study group homogenization [10].

Cytokines such as IL1A, IL1B and IL1RN, play a key role in the immuno-inflammatory response, form the group of IL-1 genes, located on chromosome 2, these are the most investigated in relation to peri-implantitis and early implant failure. However, they have been somewhat contradictory [10]. Tumor necrosis factor α (TNFα) is another key proinflammatory cytokine in the early stages of the inflammatory response [11]. Similar to IL-1, they increase TNFα levels in the crevicular fluid and saliva of patients with active peri-implantitis and have been shown to correlate directly with the degree of clinical severity of peri-implant disease [12]. TNFα, has within its direct and indirect effects, the ability to stimulate bone resorption, promoting the differentiation of monocytes and macrophages to osteoclasts [12], [13]. MMP metalloproteinases are produced by osteoclasts, fibroblasts, gingival sulcus epithelial cells, endothelial cells, plasma cells, monocytes/macrophages, and neutrophils. Some polymorphisms of this genotype would have an increased risk of early implant failure [14]. The CD-14 (159-) polymorphisms of the gene encode the CD-14 membrane receptor (Differentiation Group -14). CD-14 allows monocytes, macrophages, and polymorphonuclear cells to recognize lipopolysaccharides in the walls of Gram-negative bacteria. He concluded that the presence of the CC genotype was associated with a fivefold increased risk of peri-implantitis, while the CT genotype showed a certain "protective effect" [12]. Campos [15] studied the early failure of dental implants, polymorphism of the TNF-alpha gene (G-308A) and their results indicated that TNF-alpha (the polymorphism of the G-308A gene) would not be associated with early implant failure, and its mere presence is not relevant in the Brazilian population. Yuan-Yuan Mo [16] studied the association between tumor necrosis factor polymorphism alpha G-308A and the risk of dental peri-implant disease. It has shown that the TNF-α polymorphism (G-308A) was not significantly associated with the risk of dental implant disease. He suggests extending samples in genetic studies. In the 2019 review by Chen X and Zhao Y [17], he highlights the lack and limitations of studies on genetic polymorphisms available to reach accurate conclusions. They also confirm that the loss of dental implants in some patients cannot be explained by clinical factors alone, and several phenomena imply the existence of genetic risk factors for implant failure. Mo YY [16], in his study found that IL-1A-889C/T or IL-1B+3954C/T genetic polymorphisms were associated with peri-implantitis risk and periodontal status.

He K [18], evaluated three genetic variants including tumor necrosis factor-alpha (TNF-α)-308G/A, interleukin-1 alpha (IL-1A)-889C/T, and IL-1 beta (IL-1B) +3954C/T, as risk factors for peri-implantitis, in a Chinese population. Their results suggested that IL-1A-889C/T or IL-1B+3954C/T genetic polymorphisms were associated with the risk of peri-implantitis and periodontal inflammatory status. They stated that genetic polymorphisms are constant and can be measured before disease onset, so they could be of great benefit for treatment planning and prognosis [18]. Then inflammation has a critical effect on osseointegration and implant success. This, if it persists over time, leads to loss of supporting tissue, particularly bone, resulting in implant failure. A single nucleotide polymorphism (SNP) of pro-inflammatory mediator genes can affect their amino acid expression or sequence levels and, consequently, the host's inflammatory response. The identification of polymorphic variants that could be related to the loss of implants will allow the development of a preventive intervention protocol. In some sociocultural contexts, an alternative to stop or reduce the incidence of implant losses in the population. These methodologies should be applied more rigorously to patients with other risk factors.

Worldwide, algorithm-based diagnostic techniques are applied in periodontics and other areas, which constitute a fundamental contribution to the design of health policies and improve the quality of life of subjects. That is why we believe that the clinical areas in conjunction with the basic sciences will contribute to implantology scientific objectivity and will allow to determine characteristic patterns of these complications in the population that can later be used to select the best program of prevention, treatment, and distribution of resources for our population with rational criteria.

Therefore, the hypothesis of this work was that polymorphic population variations influence the survival rate of dental implants.

Objective: To analyze the relationship between IL-10 A/G polymorphisms rs1800896 and TNF-α G308A

rs1800629308 with the loss of one or more dental implants.

Specific objectives:

1) To characterize the population in relation to its dental parameters of the groups of patients without failure and with loss of one or more implants.
2) To determine the frequency of haplotypes and genotypes of the polymorphisms IL-10 A/G rs1800896 and TNF-α G308A rs1800629308 in the groups of patients with and without dental implant failure.
3) To relate the allelic and genotypic frequencies of the IL-10 A/G polymorphisms rs1800896 and TNF-α G308A rs1800629308 and the clinical characteristics of patients with and without dental implant failure.

TABLE I: VARIABLES STUDIED AND THEIR CONSTRUCTS TO DETERMINE THE DIFFERENT CATEGORIES OF EACH ONE

Variable Category	Category	Criterion cut-off point
Early Failure Dental Implant PI	PI Control	Control Implant loss 6 months after placement.[3]
Sex	Male Sex: 0; Female: 1	Biological genotype
Risk habits	No: 0; Smoke :1; Alcohol :2	According to the patient's response (anamnesis). And according to criteria of Secchi [19].
Gene/Polymorphism	Presents:1 No Present: 0	According to what was published in the (National Center for Biotechnology Information (nih.gov)

Implant loss was determined according to the criteria of Derks [20].
DNA Isolation and Technique for Restriction Fragment Length Polymorphisms.

II. MATERIALS AND METHODS

We conducted a cross-sectional study of adult patients, over 18 years of age (n=140) of both sexes, who attended by spontaneous demand to the Specialization Career in Oral Implantology, Faculty of Medicine of the UCC, Dental Circle of Córdoba, Catholic University of Córdoba. The clinical, genetic, and environmental data were recorded in a single coded Clinical Record for the protection of patient data.

Study groups: Cases: The patients' considered cases were those who underwent rehabilitation with unitary or multiple implants and some or all of them failed six months after their placement (early failure).

Controls: The patients' considered controls were those who underwent rehabilitation with unitary or multiple implants and none of them failed six months after their placement. They were recruited in the same period and in the same place as the cases.

Exclusion criteria: patients who presented systemic diseases, chronic alcoholism (understood as induction of generalized neuroadaptations of the nervous system that can last a lifetime, involving remodeling of synapses that are dependent on changes in gene expression in the presence of chronic alcohol consumption), drug use, intravenous medication for osteopenia or osteoporosis and with alterations in thyroid hormones. The variables smoking and alcohol consumption were categorized according to criteria of Secchi [19].

Ethical aspects: This study was conducted in accordance with the Declaration of Helsinki and was approved by the Research and Ethics Committee of the Ministry of Health of the province of Córdoba (No. 1379); All patients (controls and cases) signed the informed consent forms.

Samples of normal buccal mucosa, corroborated by Pap staining, were obtained by brushing and stored in sterile Eppendorf tubes at -30°C. DNA was isolated as previously described by Zarate [21] Genomic DNA was used to perform the polymerase chain reaction (PCR) and genotyped by restriction fragment length polymerase (RFLP).

The genotypes of the polymorphisms IL-10 A/G rs1800896 and TNF-α G308A rs1800629 308 were analyzed after PCR amplification the IL-10 A/G polymorphism rs1800896 was analyzed using primers 5´-TCTTACCTATCCCTACTTCC-3´ and 5´-CTCGCTGCAACCCAACTGGC -3´. The PCR product (344 bp) was digested with MnlI at 37 ° C for 3 h, and polymorphisms were determined as AA (wild type-139 bp), AG (139, 106 and 22 bp) and GG (106 and 33 bp). For the TNF-α G308A rs1800629 308 polymorphism, primers 5'-GGGCGGGGATTTGGAAAGTTGG-3´y 5'-ACCCCGTTTTCTCTCCCCCTCAAG-3' were used. The PCR product was digested with NcoI at 37° C for 3h, and polymorphisms were determined as GG (wild type-87 and 20 bp), AA (107 bp) and AG (107, 87 and 20 bp).

It was not possible to determine all polymorphisms in all subjects. PCR was obtained in a final volume of 50µl. PCR amplification was performed in BioRad's iCycler thermal cycler, using the following protocol: 5 minutes at 95ºC, 30 seconds at 95ºC, 30 seconds at 60ºC -55ºC depending on the SNP, and 45 seconds at 72ºC for 35 cycles, with an additional 5 minutes at 72ºC after the last cycle. PCR products were separated into a 3% TBE agarose gel (Tris/Borate/EDTA) and stained with ethidium bromide. A DNA marker of 100 bp (Cien Marker- Promega USA) was used. Negative control was performed with all reagents excluding the patient's DNA.

STATISTICAL ANALYSIS: Categorical data were described by absolute and relative frequencies%, and quantitative variables were described by median/mean and standard range/error. Fisher's test was used to evaluate the bivariate association of variables (2x2 Contingency Table), Odds Ratios (OR) and their respective 95% Confidence Intervals (95% CI). The critical level to establish statistical significance was set at $p \leq 0.05$. The data were analyzed by the software Info stat, professional version 2020 [22].

RESULTS: Demographic and clinical characteristics of the patients: The population was comprised of male and female individuals in similar proportions (p=0.6121), in general the patients were smokers and did not consume alcohol (see Table I and II), in relation to periodontal disease of all patients, 31% presented the disease (see Table III). The average age was 53.06±16.22 years, and the range of age variation was between 20 and 80 years.

TABLE II: SOCIOCULTURAL AND BIODEMOGRAPHIC CHARACTERISTICS OF THE POPULATION UNDER STUDY. AF: ABSOLUTE FREQUENCY; RF%: RELATIVE FREQUENCY IN PERCENTAGE P-VALUES <0.05 INDICATE STATISTICAL SIGNIFICANCE

Variable	Category	Absolute Frequency	Relative Frequency Expressed in %	p-value
Sex	Male	47	45.6	0.4772
	Female	56	54.4	
Smoking[1]	No	62	60.19	0.0385
	yes	41	39.81	
Alcohol[2]	No	86	83.50	0.0001
	yes	17	16.50	

1Smoker: current consumption of at least one cigarette/day for a minimum period of 1 year.
2Alcohol: current consumption of 2 drinks/week for a minimum period of 1 year.

Of the patients with missing implants and controls, whose initial number was 12, four who had other associated diseases such as breast cancer, thyroid disease and one patient whose genotype could not be performed were excluded. The age range among patients with missing implants ranged from 47 to 79 years. It was observed that 5/8 patients who had implant loss were women. 7.7% of patients included in the study had loss of their implant; of which 7/8 smoked and only one had periodontal disease (see Tables III and IV). In addition, it was observed that 2/8 patients had occlusal trauma.

TABLE III: CLINICAL DENTAL CHARACTERISTICS OF THE PATIENTS

Variable	Category	Absolute Frequency	Relative Frequency Expressed in %	p-value
Periodontal disease	No	101	98.06	0.0001
	Yes	2	1.94	
Implant	Not lost	95	92.23	0.0001
	Lost	8	7.77	
Trauma*	No	88	85.44	0.0001
	Yes	15	14.56	

*According to the criteria of Piemonte [23].

Distribution of alleles and genotypes of the two SNPs: In relation to the genotype, 50% of the patients with lost implants presented the mutated allele of the SNP TNFα rs1800629 (see Table IV); while 50% of the patients with periodontal disease were carriers of the mutated allele for the SNP IL-10 rs1800896 (see Table V).

TABLE IV: CHARACTERISTICS OF THE GROUP OF PATIENTS WITH LOST IMPLANTS

ID patients	Sex	Age (years)	Smok-ing	Alco-hol	Trau-ma	Periodontal disease	IL-10	TNFα
P96	Female	47	Yes	No	No	No	AA	GA
P97	Male	65	No	No	No	No	AA	GG
P98	Female	49	Yes	No	Yes	No	AA	GG
P99	Male	69	Yes	Yes	No	No	AG	GG
P100	Female	75	Yes	No	Yes	Yes	AA	GA
P101	Male	53	No	No	Yes	No	AA	AA
P102	Female	64	Yes	no	No	Yes	AA	AA
P103	Male	79	Yes	no	No	No	AA	GG

Healthy alleles: A for SNP (Single Nucleotide Polymorphism) IL10 and G for SNP TNFα.

On the other hand, considering the total population under study (n=103), 31.06% of the patients presented the genotypes with the genetic variation, AG+GG, of the IL10 AG rs1800896 gene, while 64.07% presented the AA and GA genotypes (both with the mutated allele) of the TNF-α G308A rs1800629 gene (see Table VI). No significant association (p=0.3298) was observed between SNP IL10 genotypes and periodontal disease (see Table VII); contrary if there was a significant relationship between the existing periodontal disease (0.0164) (see Table VIII).

TABLE V: CHARACTERISTICS OF THE GROUP OF PATIENTS WITH PERIODONTAL DISEASE

ID patients	Sex	Age (years)	Smoking	Alcohol	Trauma	*IL-10*	*TNF*
P104	Male	69	No	No	No	AA	GG
P105	Male	22	No	No	No	AA	GG
P106	Female	57	No	No	No	AG	GG
P107	Male	20	No	No	No	AA	GG
P108	Female	30	No	No	No	AG	GG
P109	Male	35	No	No	No	AG	GG
P110	Female	63	No	No	No	AA	GG
P111	Male	53	No	No	No	AG	GA
P112	Male	51	Yes	No	Yes	AG	GA
P123	Male	55	No	No	No	AA	GG

Healthy alleles: A for SNP (Single Nucleotide Polymorphism) IL10 and G for SNP TNFα.

TABLE VI: GENOTYPE FREQUENCIES OF THE SINGLE NUCLEOTIDE POLYMORPHISMS STUDIED

Studied Polymorphisms	Genotypes	Absolute Frequenc	Relative Frequency Expressed in %	p-value
IL-10 A/G rs1800896	AA* (dominant homozygous)	71	68.93	0.0001
	AG (heterozygous)	28	27.18	
	GG (recessive homozygous)	4	3.88	
TNF-α G308A rs1800629	AA (recessive homozygous)	26	25.24	0.2055
	GA (heterozygous)	40	38.83	
	GG*(dominant homozygous)	37	35.92	

DISCUSSION: There is currently no information in the scientific literature on the characterization of the population of Córdoba, Argentina, in relation to the SNPs evaluated in this study and their relationship with implant loss and periodontal disease. The ethnic origin of the Argentine population is heterogeneous, due to immigration from Europe and its integration with the original population. 90% have European, mainly Italian, and Spanish descent and 50% with some indigenous legacy. There are also origins of at least 5% Africans in the population [24].

TABLE VII: GENOTYPE FREQUENCIES OF THE SINGLE NUCLEOTIDE POLYMORPHISMS STUDIED IN RELATION TO THE PRESENCE/ABSENCE OF PERIODONTAL DISEASE. AF: ABSOLUTE FREQUENCY; RF%: RELATIVE FREQUENCY EXPRESSED IN %

Polymorphism	Genotype	No periodontal disease AF (RF%)	Yes, disease periodontal AF (RF%)	p-value
IL-10 A/G rs1800896	AA* (dominant homozygous)	64 (67.4%)	5 (50%)	0.3298
	AG (heterozygous)	27 (28.4%)	5 (50%)	
	GG (recessive homozygous)	4 (4.2%)	0 (0%)	
	A* healthy allele	155 (81.6%)	15 (75%)	0.4760
	G non healthy allele	35 (18.42%)	5 (25%)	
TNF-α G308A rs1800629	AA recessive homozygous)	24 (25.3%)	0 (0%)	0.0164
	GA (heterozygous)	38 (40.0%)	2 (20.0%)	
	GG*(dominant homozygous)	33 (34.7%)	8 (80.0%)	
	A non-healthy allele	86 (45.3%)	2 (10.0%)	0.0024
	G* healthy allele	104 (54.7%)	18 (90.0%)	

*Healthy allele.

TABLE VIII: GENOTYPE FREQUENCIES OF THE SINGLE NUCLEOTIDE POLYMORPHISMS STUDIED IN RELATION TO LOSS OR NOT OF DENTAL IMPLANT. AF: ABSOLUTE FREQUENCY; RF%: RELATIVE FREQUENCY EXPRESSED IN %

Studied Polymorphisms	Genotype	Implant		p-value
		No lost AF (RF%)	Lost AF (RF%)	
IL-10 A/G rs1800896	AA* (dominant homozygous)	64 (67.4%)	7 (87.5%)	0.4822
	AG (heterozygous)	27 (28.4%)	1 (12.5%)	
	GG (recessive homozygous)	4 (4.2%)	0 (0%)	
	A* healthy allele	155 (81.6%)	15 (93.7%)	0.3153
	G non healthy allele	35 (18.42%)	1 (6.3%)	
TNF-α G308A rs1800629	AA recessive homozygous)	24 (25.3%)	2 (25%)	0.6356
	GA (heterozygous)	38 (40.0%)	2 (25%)	
	GG*(dominant homozygous)	33 (34.7%)	4 (50%)	
	A non-healthy allele	86 (45.3%)	6 (37.5%)	0.6486
	G* healthy allele	104 (54.7%)	10 (62.5%)	

The population of Córdoba shows a high frequency of the A allele, of the IL10 gene. Consistent with observations from studies conducted in Mexico [25] and Brazil [26] in which the proportions were similar to those observed in this study. The G allele of the TNFα gene is the most frequent in our studied population. We observed a frequency of 74.75% of this allele, which was consistent with that observed in other populations [27 - 28]. In relation to allelic frequency, Gurol [29] showed that allele A at position -1082 was (63%) in healthy subjects than in those with implant failure (50%), chronic periodontitis (47%) and healthy implants (48%), agreeing with our results. Singh [30] observed that a higher prevalence of dental implant failures in men (11%) than in women (9%), contrary to our population. Moy [31] Determined that, in women over 60 years of age, with postmenopausal cancer or diabetes, and with smoking, they lost their implants, we observed that 75% of patients were smokers and the age of implant failure was between 47 and 79 years. Since previous studies reported that systemic diseases can lead to implant failure, including the influence of immune system regulation on metabolism and bone density, data from patients with systemic diseases in our study were not considered [32] 25% of patients included in our study who lost implants had periodontal disease. The prevalence of peri-implantitis was approximately 22% (range: 1–47%) however, the WHO describes a much lower value, almost 10% of the world's population claims to be affected by periodontal diseases [33]. 87.5% of patients with missing implants had the AA genotype for IL-10 and 50% had the GG genotype of TNFα.

Wong [33] In a systematic review, a systematic review described periodontitis prevalence values of 22% (range: 1–47%). 25% of patients included in our study who lost implants had periodontal disease. With respect to the IL-10 gene and periodontal disease our study does not show a significant relationship, although the author contradicts our results.

In addition, we observed no significant association between IL-10-1082 A/G and the loss of dental implants; agreeing with Chen X [17] with respect to TNF-α, we observed a higher frequency of this PNS in patients with periodontal disease. Along the same lines as Duarte [34]. Rakic [35] agrees with us in presenting in their study that the GA genotype of the TNF-α polymorphism (G-308A) is effectively associated with peri-implantitis; Carriers with this genotype have a fivefold increased risk of peri-implantitis [35]. These results also agree with the study by Kinane [36] which found no association between IL-10 gene polymorphism and periodontitis. We also agree with the results of Santiago meta-analysis [37] that did not demonstrate an increased risk or protection in dental implant failure due to DNA variations in IL10 and TNFα in the study groups compared to the control groups. We have no strong evidence that the genetic factors studied can lead to the failure of oral rehabilitation with dental implants. Gurol [29] evaluated 39 patients with implants and found no statistical relationship between IL-10 polymorphism (-1082) and implant failure, our study confirms these findings. Also, in the same line as our study, other authors suggested that the TNF-a-308 G/A polymorphism was not associated with early implant failure [38], [39]. Now, Jacobi-Gresser [40], differing from our study, observed that GA or AA genotypes of the TNF-α polymorphism (G-308A) are more frequent in cases and are associated with an increased risk of implant failure. As IL-1 and TNF-a play an important role in the immuno-inflammatory response, these authors hypothesized an effect of functional polymorphisms in these genes on the survival of the titanium implant. Based on the concept that implant failure is a multifactorial procedure influenced by a variety of conditions, this study corroborates the importance of the host's immune response to dental implant outcome [40].

Our study did not show a statistical significance of the

genotypes studied in relation to the loss of implants which also agree with those of Chen [17] supporting the existence of genetic susceptibility, but this remains unresolved.

III. Conclusion

It is the first study that describes genetic variations in a population of Córdoba. The polymorphisms evaluated were not predictive of dental implant failure. There is a significant relationship between periodontal disease and TNF-α genotype, with 3/11 patients reported with the normal allele. When the patients individually in the periodontal disease group are described, it is observed that most are homozygous for the normal TNF allele (GG) and 50% heterozygous carriers of the mutated allele (GA) for IL 10. This could lead us to assume that these patients have osteolytic capacity given by TNF and a lower capacity to maintain the integrity and homeostasis of the epithelial layers given by the mutated IL 10 allele. This should be corroborated in further in vivo or in vitro studies.

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Conflict of Interest

Authors declare that they do not have any conflict of interest.

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