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Periodontitis: Possible role of Mitochondrial DNA Mutations

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Centre for Cellular and Molecular Biology, Hyderabad, India.

Introduction

Mitochondrial DNA mutations have been well documented in several human diseases. Mitochondrial structures are susceptible to oxidative damage by induced ROS, which are generated continuously by the mitochondrial respiratory chain. Mitochondria are also major sites for the accumulation of low molecular weight Fe2+ complexes, which promote the oxidative damage.Thus, it leads to mitochondrial dysfunction by damaging mitochondrial DNA (mtDNA), and this mtDNA damage is associate with aging process. There is no comprehensive study on the impacts of mtDNA mutations in Periodontotitis. Hence, we initiated this study, to understand the possible association of mtDNA in causing Periodontotitis.

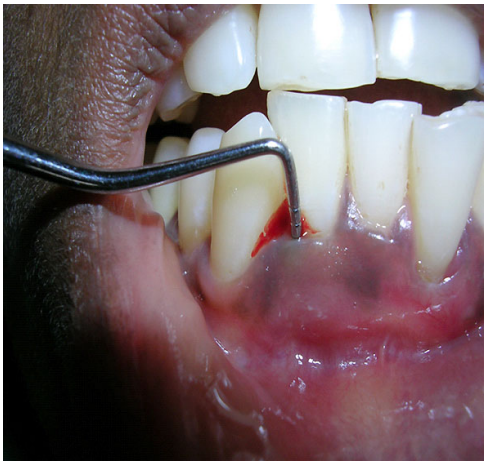


Fig. 1

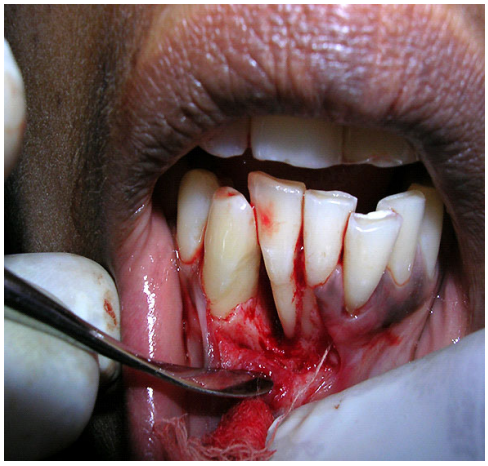


Fig. 2

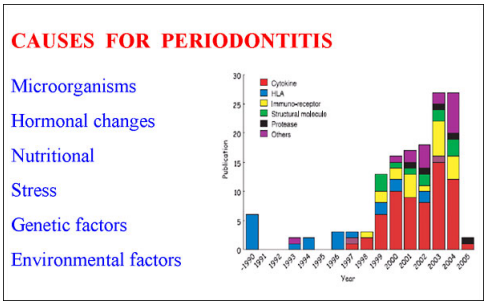


Fig. 3

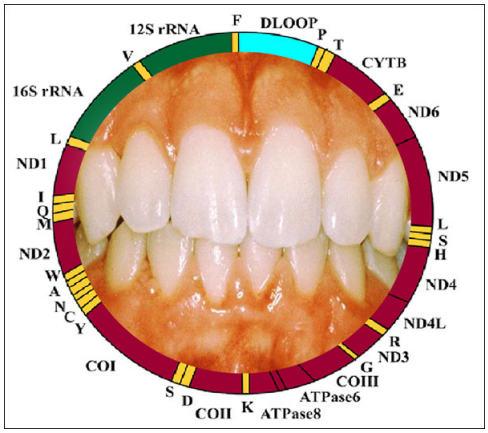


Fig. 4

Objectives

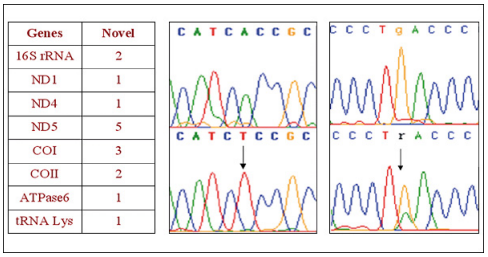
Possible association between Mitochondrial DNA mutations and chronic periodontitis.

Material and Methods

Clinical evaluation of a sample pool and the patients fulfilling the inclusion criteria were selected.Sample collections: attached gingiva was collected during periodontal surgery from 30 patients. On the samples, DNA isolation, Polymerase chain reaction, Complete sequencing of mtDNA, Sequencing analysis and Comparative genomics were performed.

Results

We found 264 variants/mutations across the mtDNA. A total of 16 novel mutations were found of which 3 were novel missense mutations and remaining 13 were polymorphic.
Two were heteroplasmic mutations. Eight mutations were reported to be associated with other mitochondrial disorders. Evolutionary analysis of these patients showed diverse mtDNA haplogroup background.



Genes	Novel
16S rRNA	2
ND1	1
ND4	1
ND5	5
COI	3
COII	2
ATPase6	1
tRNA Lys	1

Fig. 5: A total of 16 novel mutations were found of which 3 were novel missense mutations and remaining 13 were polymorphic.

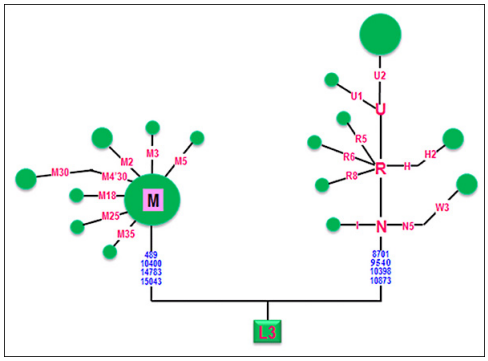


Fig. 6: Evolutionary analysis of these patients showed diverse mtDNA haplogroup background.

Conclusions

Mutations were observed in different genes across the mitochondrial genome. Haplogrouping revealed that the periodontitis occur at different ethnic backgrounds.
Present study suggests the possible role of mitochondrial DNA in periodontitis, however more samples from different ethnic background is needed to provide additional evidence for the role of mtDNA variation in periodontitis.

Literature

1. Chapple ILC: Reactive oxygen species and antioxidants in inflammatory diseases. Journal of Clinical Periodontology 1997, 24, pp.287-296.
2. Canakçi CF., Tatar A., Canakçi V., Cicek Y., Oztas S., Orbak R: New evidence of premature oxidative DNA damage: mitochondrial DNA deletion in gingival tissue of patients with periodontitis. Journal of Periodontology 2006, 77, pp.1894-1900.
3. Tomofuji T., Azuma T., Kusano H., Sanbe T., Ekuni D., Tamaki N., Yamamoto T., Watanabe M: Oxidative damage of periodontal tissue in the rat periodontitis model: effects of a high-cholesterol diet. FEBS Letters 2006, 580, pp.3601-4.

Abbreviations

mtDNA = Mitochondrial DNA
rRNA = Ribosomal RNA
ND = NADH dehydrogenase
CO = Cytochrome c oxidase
ATPase = ATP synthase
tRNA = Transfer RNA

This Poster was submitted by Dr Rampalli Viswa Chandra.

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Poster Faksimile:

Periodontitis: Possible role of Mitochondrial DNA Mutations

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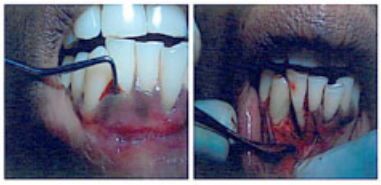
INTRODUCTION

Periodontitis is an inflammatory disease affecting the tissues that surround and support the teeth, as a result of complex interactions between pathogenic bacteria and the host's immune response.

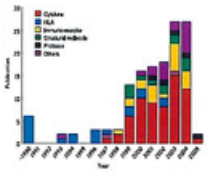
Gingivitis, the mildest form of periodontal disease, is highly prevalent and readily reversible by simple, effective oral hygiene. Gingivitis affects 50–90% of adults worldwide.

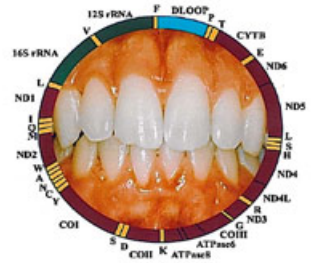
Prevalence of periodontal disease in adult population is 33.4 to 47.1%



CAUSES FOR PERIODONTITIS

- Microorganisms
- Hormonal changes
- Nutritional
- Stress
- Genetic factors
- Environmental factors





MITOCHONDRIA AND PERIODONTITIS

Mitochondrial DNA mutations have been well documented in several human diseases.

Mitochondrial structures are susceptible to oxidative damage by induced ROS, which are generated continuously by the mitochondrial respiratory chain.

Mitochondria are also major sites for the accumulation of low molecular weight Fe2+ complexes, which promote the oxidative damage.

Thus, it leads to mitochondrial dysfunction by damaging mitochondrial DNA (mtDNA), and this mtDNA damage is associate with aging process.

There is no comprehensive study on the impacts of mtDNA mutations in Periodontotitis.

Hence, we initiated this study, to understand the possible association of mtDNA in causing Periodontotitis .

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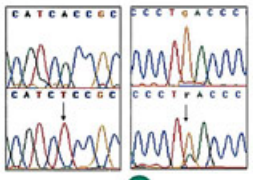

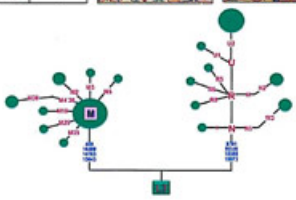

METHODOLOGY

- Clinical evaluation
- Sample collections
- DNA isolation
- Polymerase chain reaction
- Complete sequencing of mtDNA
- Sequencing analysis
- Comparative genomics

RESULTS

We found 264 variants/mutations across the mtDNA.

A total of 16 novel mutations.

Of which 3 were novel missense mutations and remaining 13 were polymorphic.

Two were heteroplasmic mutations.

Eight mutations were reported to be associated with other mitochondrial disorders.

Evolutionary analysis of these patients showed diverse mtDNA haplogroup background.

DISCUSSION AND CONCLUSION

Mutations observed in different genes across the mitochondrial genome.

Haplogrouping revealed that the periodontitis occur at different ethnic backgrounds.

Present study suggests the possible role of mitochondrial DNA in periodontitis, however more samples from different ethnic background is needed to provide additional evidence for the role of mtDNA variation in periodontitis.

FUTURE WORK

Electron Microscopic study.

Biochemical assay.