

# Peculiarities of The Regional Distribution of CD3 Positive T-Lymphocytes in Tonsillar Compartments During the Different Degrees of Dental Caries Activity

*Gogi Kipiani, Otar Khardzeishvili, Zurab Vadachkoria*

Department of Pediatric Dentistry and Prevention of Dental Diseases,  
Department of Pathological Anatomy, Tbilisi State Medical University.

## **Abstract**

On the basis of clinical and experimental studies of 64 cases of children after tonsillectomy quantitative distribution of CD 3 positive T-lymphocytes in tonsillar tissue during the various degrees of activity of dental caries have been studied. The research established quantitative peculiarities of CD 3 positive T lymphocytes in different zones of tonsils in case of dental caries. It was revealed that depending on the degree of caries activity the quantity of CD 3+ T lymphocytes considerably increases in the tonsillar zone of lympho-epithelial symbiosis. Results of the study allow us to conceive the role of T-lymphocytes in the accomplishment of primary and secondary immune reactions in the palatine tonsil, which gives us certain basis to evaluate in a right way the role of chronic pathologies of palatine tonsils in the pathogenesis of dental caries.

**Keywords:** *tonsillitis, T-lymphocytes, dental caries activity*

## **Introduction**

It's generally accepted that tonsils supply immune system with information about environment, and that's why they are considered analyzers of the first line (12). A certain similarity between tonsils and thymus deserve attention. Both in thymus and tonsils there is the zone of lympho-epithelial symbiosis and Hassall's corpuscles. However, it's noteworthy that unlike thymus antigens can penetrate into the tonsils from the outside through the crypts and they have sites of reproduction [2].

Special literature has accumulated the works, which indicate importance of general and local immune status in the pathogenesis of dental caries [5, 7].

At the same time researches for the last period of time detect that regional lymphoid organs, particularly

palatine and pharyngeal tonsils [6, 10] have a leading role in formation of the immune status of oral cavity. Tonsils are considered lymphoid organ, which supplies oral cavity with immunoglobulins. On the other hand, it's established that infectious antigens play a leading role in the pathogenesis of dental caries. That's why we can infer with high probability that pathogenic influence of microbe antigens is largely associated to the condition of palatine tonsils.

The purpose of our research was to study a quantitative distribution of CD 3 positive T-lymphocytes in tonsillar tissue during the various degrees of activity of dental caries.

## **Material and Methods**

Palatine tonsils (81 tonsils) to be studied were obtained from 64 children of 9-year old who had undergone

tonsillectomy. All cases of tonsillectomy were sorted into four groups according to the clinical diagnostic algorithm data made for each patient.

The first (control) group included the children with caries-free teeth (4 patients). The children in the second group (28 patients) suffered from the 1st degree of caries activity; the third group (14 patients) showed the 2nd degree of caries activity and the 3rd degree of caries activity was in the fourth group (18 patients).

We performed the fixation of post-operative material in the universal fixation device GLIO-FIXX ("SHANDON"). Paraffin sections were stained by hematoxylin-eosin and picofuxin by the method of Van Gizon. Immuno-histochemical method was used for detection of CD 3 positive T lymphocytes. Visualization system LSAB (method of labeled streptavidin-biotin) and substrate DAB Diaminoben-Zidini (all reagents were production of "DAKO"). The staining of section was performed by GILL -2 hematoxylin (production of "SHANDON").

We performed the evaluation of the quantity of CD 3 positive

T -lymphocytes in the zone of lympho-epithelial symbiosis of tonsils, in the sites of follicle reproduction, in the Mantle zone and in the inter-follicular diffuse lymphoid tissue. We conducted the quantitative study of cells was performed by the lattice of G. Avtandilov.

We performed the processing of figures by mean of the computer software PRIMER BIOSTATICS 4.02.

## Results

The distribution of CD 3 positive T lymphocytes in the tonsillar compartments, according to the tonsillar zones showed the following picture. (*Tab.1*)

- Depending on the degree of caries activity the quantity of CD 3 positive T-lymphocytes considerably increases in the zone of lympho-epithelial symbiosis as compared to the control group.
- The sites of reproduction of follicles contain small number of CD 3 positive T-lymphocytes. Their quantitative figures are not changed much in 1st and 2nd degrees of caries activity, while in case of 3rd degree of caries activity the quantity of CD 3 positive T-lymphocytes decreases sharply;
- In cases of 1st and 2nd degrees of caries activity the quantity of CD 3 positive T lymphocytes in the Mantle zone doesn't change considerably, but decreases sharply in cases of 3rd degree of caries activity;
- The quantity of CD 3 positive lymphocytes in the inter-follicular diffuse tissue increases in cases of 1st and 2nd degrees of caries activity as compared to the control group, and decreases sharply in cases of 3rd degree of caries activity.

GROUP	ZONE OF LYMPH EPITHELIAL SYMBIOSIS	SITE OF FOLLICLES REPRODUCTION	MANTLE ZONE	INTER-FOLLICULAR DIFFUSE LYMPHOID TISSUE
Control Group	0,25 ± 0,55	0,55±0,6863	0,6 ± 0,9947	4,095 ± 1,932
1 <sup>st</sup> Degree of Caries Activity	0,65 ± 0,7133	0,5 ± 0,9001	0,6875 ± 0,9222	6,387 ± 1,852
2 <sup>nd</sup> Degree of Caries Activity	0,5 ± 0,7609	0,6429 ± 1,65	0,925 ± 1,095	8,6 ± 1,057
3 <sup>rd</sup> Degree of Caries Activity	1,225 ± 1,097	0,25 ± 0,4385	0,2 ± 0,5164	5,6 ± 2,59

**Tab.1** Regional distribution of CD3 POSITIVE T- lymphocytes in intro-tonsillar compartments in respective clinical groups.

## **Discussion**

The research we had conducted established quantitative peculiarities of CD 3 positive T-lymphocytes in different zones of tonsils in case of dental caries.

It has been detected that quantitative figures of CD 3 positive T lymphocytes are interdependent with clinical course of dental caries. Specifically, a sharp increase of CD 3 positive T-lymphocytes in the zone of tonsils' lympho-epithelial symbiosis along with increase of the degree of dental caries activity has been revealed. At the same time both in the sites of follicle reproduction, Mantle zone and inter-follicular diffuse tissue the quantity of CD 3 positive T lymphocytes first increases and then drops sharply. The aforementioned changes are likely related to the functional load of CD 3 positive T-lymphocytes.

Special literature reports that T lymphocytes can be found in any zones of tonsils [6]. Perhaps high figures of lymphocyte quantity in the inter-follicular diffuse lymphoid tissue are related to the passive accumulation of cell population in these zones. Meanwhile, it's known that inter-follicular diffuse tissue of tonsils is called as ordinary T zone, and represents the base for implementation of suppressor and helper effects by the blood-delivered T-cells.

It's established that the T lymphocytes detected in the inter-follicular diffuse tissue are mostly found around the inter digital antigen-presenting cells and bear CD 4 positive (helper) phenotype.

What's noteworthy among the T-Helpers subtypes of memory (CD45RO+) and subtypes not stimulated by antigen (CD45RA+) are found. Some T-lymphocytes show interleukin (IL-2R and/or CD25) receptors after the activation. This is a cause of both primary and secondary immune reaction in tonsils.

Our studies show high functional activity of T lymphocytes in cases of 1st and 2nd degrees of the dental caries, while in case of 3rd degree of dental caries deficiency of T-lymphocytes is observed. This can be considered the main precondition for formation of deficiency of cellular dependent immunity.

The data we have obtained evidently confirm the importance of the cellular- dependent immunity in protection of teeth from caries, which has been several times reported in the works related to the studies of caries vaccination experimental models [4.8.11] and during the clinical trials as well [9].

The study has shown that the picture of distribution of lymphocytes in the sites of follicle reproduction and the

Mantle zone is similar to the changes revealed in inter-follicular diffuse lymphoid tissue. Specifically, during the caries the quantity of CD 3 positive lymphocytes increases in cases of 1st and 2nd degree of caries activity and sharply decreases in case of 3rd degree of caries activity.

In the sites of follicle reproduction, which usually considered the sites of proliferation of B-lymphocytes, the excessive presence of T-lymphocytes indicates that the T cells of reproduction sites have the capabilities necessary for activation of B cells. Several data and findings confirm this consideration: T-cell reveals IL-2R marker [1], T-cells are necessary for starting the mutation of the V gene, which causes production of high-affined antibodies, both in non-antigen stimulated and activated B cellular populations [3]. Hence, during the caries in the background of

T-Lymphocyte deficiency we can presume the decrease of activity of B lymphocytes as in the sites of follicle reproduction so in other zones, which first of all is expected in case of the 3rd degree of caries activity.

The study has shown that in dental caries the picture of distribution of

CD 3 positive T-lymphocytes in the zone of lympho-epithelial symbiosis significantly differ from the picture of distribution of CD 3 positive lymphocytes in other zones (compartments) of tonsil. The increase of quantity of CD 3 positive T-lymphocytes in the zone of lympho-epithelial symbiosis as compared to the control group indicates the strengthening of T-lymphocyte function in this zone. This is the zone of reception of information about antigen and its further transmission to the inter-follicular diffuse lymphoid tissue and sites of follicle reproduction. This function is carried out thanks to co-participation of dendritic cells and macrophages located in tonsils' reticular crypt epithelium [6]. Therefore, high figures of CD 3 positive T- lymphocytes during the caries activity of 3rd degree can be explained by high titer of caries-provoking microbe antigen in oral cavity and saliva [7].

Consequently, results of the study, specifically the picture of distribution of CD 3 positive T-lymphocytes in various zones (compartments) of palatine tonsils during the dental caries allow us to conceive the role of T-lymphocytes in the accomplishment of primary and secondary immune reactions in the palatine tonsil, which gives us certain basis to evaluate in a right way the role of chronic pathologies of palatine tonsils in the pathogenesis of dental caries

## References

1. Bowen M.B. et al. Germinal Center T cell are distinct helper-inducer T cells. // *Cell Immunil.* - 1991. V.31.- p.67-75
2. Donovan R. et al. Immunological studies in children undergoing tonsillectomy. // *Clin. Exp. Immun.*, 1993. -v.14.-p.347
3. Francus T. et al. Memory T cells enhance the expression of high-avidity naive B cells. // *Cell Immunol.*- 1991.- v.134. - p.520-527
4. Fukuizumi T. et al. Tonsillar application of formalin killed cells of *Streptococcus sorbinus* reduces experimental dental caries in rabbits. // *Infection and Immunology.* -1999.-67(1).-p.426-428
5. Hajishengallis G., Michalek S.M. Current status of mucocosal vaccine against dental caries. // *Oral Microbiology and Immunology.* - 1999.- v.14(1).- p.1-20
6. Hans-Peter Zenner. Immunological aspects of tonsils and tonsillitis.// *Acta Otolaryngol.* -1988. V.454. - p. 70-74
7. Kinstila V. et al. Longitudinal analysis of the association of human salivary antimicrobial agents with caries increment and cariogenic microorganisms: a two year cohort study. // *Journal of Dental Research.* - 77(1). p.73-80
8. Lehner T. et al. The role of IgG, Ig and IgM classes of antibodies to streptococcus mutans in protection against caries in rhesus monkeys. // *International Symposium on Streptococci and Streptococcal Diseases.* - Oxford. - p. 215-217
9. Parcash H. et al. Differential cell-mediated immune response to *S. mutans* in children with low and high dental caries. // *Indian Pediatrics.* 1993.- v.30(8).- p. 991-996
10. Per Brandzaeg, Trond S. Halstensen. Immunology and Immunopathology of Tonsils. // *Adv. Otorhinolaryngol.* Basel, Karger. 1992. -v.47.- p.64-75
11. Senpuku H. et al. Immunogenicity of peptides coupled with multiple
12. T-cell epitopes of surface protein of *Streptococcus mutans*.
13. // *Immunology.* -1996. - v.88(2). -p. 275-283
14. Veldman H. Histopathology and electron microscopy of the immune
15. response. // *Cell Immunology.*, - v. 15. - p.27-30

## **Особенности интратонзиллярного регионального распределения CD3+ Т-лимфоцитов при различной степени активности кариеса зубов**

*Георгий Кипиани, Отар Хардзешивили, Зураб Вадачкория*

Кафедра детской стоматологии и превенции зубных болезней Тбилисского  
государственного медицинского университета  
Кафедра патологической анатомии Тбилисского государственного медицинского  
университета

### **Р Е З Ю М Е**

Материалом для морфологического исследования служили небные миндалины, удаленные при хроническом тонзиллите у 64 школьников в возрасте 9 лет. Парафиновые срезы окрашивали с применением гематоксилин-эозина, пикрофуксина по Ван Гизону и исследовались иммуногистохимическим стрептавидин-биотиновым методом с помощью моноклональных антител. Установлено, что количество CD3+ Т-лимфоцитов зависит от степени активности кариозного процесса и характеризуется региональной особенностью интратонзиллярного распределения.

**Ключевые слова:** *тонзиллит, Т-лимфоциты, активность кариеса*