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# Oral cleanliness and gingival health condition in relation to body mass index and certain salivary immunoglobulin among tonsillectomies children

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## ABSTRACT

**Background:** The tonsils are clumps of tissue on both sides of the back of the throat. Tonsillitis is an infection of the tonsils caused by a virus or bacteria. surgery to remove the infected tonsils was a common procedure. they're usually only recommended if tonsillitis is severe, occurs frequently and doesn't respond to other treatments. Obstructive tonsils became currently the most common indication for tonsillectomy in children. Tonsillectomy reduces total salivary immunoglobulin, but overall antimicrobial defense is unimpaired. This study was conducted to evaluate the oral hygiene and certain salivary immunoglobulin in a group of tonsillectomies children.

**Subjects and methods:** The study groups included 30 patients, they were tonsillectomies children, aged 8 - 10 years old of both gender, matching with control group includes 30 healthy child matching with study group in age and gender. Plaque status was evaluated according to the Silness & Loe Index, dental calculus according to Ramfjord index, while gingival condition was assessed according to Loe & Silness. After oral examination, stimulated saliva samples were collected from the subjects and performed under standard condition following instruction cited by Tenovouo & Lagerlof, and chemically analyzed for the detection of salivary immunoglobulin (IgM & IgG). In addition, BMI for the children were calculated according to this formula :-  $\text{Body weight} / (\text{height})^2 = \text{BMI kg/m}^2$ .

**Results:** Higher plaque, calculus and gingival index were recorded among tonsillectomies children, with statistically significant differences between groups. Low levels of IgG & IgM were seen among the study group compared to the control group. A significant correlation was found between IgG and oral hygiene among tonsillectomies children. A positive highly significant correlations between BMI and PII & GI among tonsillectomies and control children ( $P < 0.05$ ).

**Conclusions:** Certain salivary immunoglobulin levels affect severally by tonsillectomy. Salivary IgM, and IgG defect seem to play a role in the development of poor oral hygiene among tonsillectomies children.

**Key words:** Oral health, salivary immunoglobulin, tonsillectomy.

## INTRODUCTION

The tonsils are clumps of tissue on both sides of the back of the throat. Tonsillitis is an infection of the tonsils caused by a virus or bacteria. Although seen in healthy adults, the illness is more common in children<sup>(1)</sup>. However, if tonsillitis is caused by a bacteria, such as group A streptococcus antibiotics can shorten the infection and prevent more serious complications<sup>(1&2)</sup>. The palatine tonsils, which are major components of the lymphoid tissue, appear to function as the host's first line of defense against exogenous microorganisms<sup>(1)</sup>. Inflammatory diseases of the tonsils constitute the most common cause of primary care visit to physicians, and tonsillectomy represents one of the most common operations performed in children<sup>(2)</sup>. Human tonsils are known to be immunologically reactive lymphoid organs which manifest specific anti bodies in response to a variety of antigens, carrying out the functions of humoral and cellular immunity<sup>(3)</sup>. Years ago, surgery to remove the infected tonsils was a common procedure. While tonsillectomies are still performed, they're usually only recommended if tonsillitis is severe, occurs frequently and doesn't respond to other treatments. Surgery may also be used if the tonsils are so large that they obstruct breathing or affect sleep<sup>(3)</sup>.

Periodontal disease is considered to be a mixed infection wherein the pathogens act directly or indirectly in the destruction of the tooth-supporting tissues. The host reacts to this bacterial challenge by activating its defense mechanisms in an attempt to localize and eventually eliminate the pathogens<sup>(2)</sup>. Periodontal disease is considered to be a mixed infection wherein the pathogens act directly or indirectly in the destruction of the tooth-supporting tissues<sup>(3)</sup>. Several studies have shown a positive relationship between the concentration of immunoglobulin and periodontal disease<sup>(3&4)</sup>. Notably, elevated levels of parotid IgA antibodies to *Aggregatibacter actinomycetemcomitans* were seen in subjects whose subgingival plaque harbored this

microorganism. Other studies have likewise reported increased IgG to *A. actinomycetemcomitans* and also to *P. gingivalis* patients with deep periodontal pockets<sup>(4)</sup>. However, accumulation of dental plaque may stimulate IgA production by increasing the amounts of swallowed bacteria. Salivary IgG was used to create a gingival immunologic defense index in the evaluation of risk for periodontal disease<sup>(4&5)</sup>. The immunological sequelae of tonsillectomy in children has long been a source of debate among physicians and a continuous concern for the parents. In some children, tonsillar growth causes upper airway obstruction. In others the tonsils become a source of recurrent febrile illness. Obstructive tonsils became currently the most common indication for tonsillectomy in children<sup>(6)</sup>. Tonsillectomy reduces total salivary immunoglobulin, but overall antimicrobial defense is unimpaired. Immunoglobulin, is an important defense against pathogens and can be used in the diagnosis of infections. How antibodies might protect against oral disease has for long been a matter of dispute, and both the role of salivary and serum immunoglobulin, in crevicular fluid have been considered<sup>(3&4)</sup>. Salivary and serum immunoglobulin, in crevicular fluid may, moreover, be decreased in children with recurrent tonsillitis and also, it has moreover been suggested that repeated antibiotic courses may lead to persistently low salivary Ig levels<sup>(6)</sup>. Various investigators have reported high serum levels of IgG and IgA in patients with chronic tonsillitis<sup>(7&8)</sup>. However, many studies indicate that inflammation and/or hypertrophy of adenoids and tonsils are caused by hypofunction of local and systemic immunity<sup>(8&9)</sup>. Although it's widely believed that sudden increases in body mass index (BMI) following tonsillectomy occur mainly in children who had their tonsils removed due to sleep apnea, the researchers found the %85 children who had the surgery for sleep apnea and the %30 who had a tonsillectomy to treat tonsil inflammation had the same rate of weight gain. BMI is a calculation of body fat based on height and weight As for literature available very little has been discussed about periodontal disease with salivary immunoglobulin and body mass index among tonsillectomies children, while no previous Iraqi study has been conducted to investigate the possible impacts of tonsillectomy on the oral immunity and oral hygiene of those children, for these reasons this study was conducted.

## PATIENTS & METHODS

The study group included 30 patients, they were tonsillectomies children, (clinically examined at the Baghdad teaching hospital department of Pediatric) aged 8 - 10 years of both gender, the patients were selected according to the duration of the tonsillectomy 1-2 years after the operation of tonsillectomy) and compare with control of healthy children (30 child), with no signs and symptoms of tonsillitis, matched in age and gender. Stimulated salivary samples were collected for both study and control groups. Salivary samples collection was started at beginning of March 2015 till beginning of May 2015, and performed under standard condition following instruction cited by Tenovuo & Lagerlof<sup>(13)</sup>, and chemically analyzed for the detection of salivary immunoglobulin (IgM & IgG) by single radial immunodiffusion<sup>(14)</sup>.

Plaque status was evaluated according to the Silness & Loe Index<sup>(10)</sup>, dental calculus according to Ramfjord index<sup>(11)</sup>, while gingival condition was assessed according to Loe & Silness<sup>(12)</sup>.

**Body Mass Index (BMI) :** This index is a number calculated from the child's weight and height, according to this formula (WHO, 2000)<sup>(15)</sup> :-

**Body weight / (height)<sup>2</sup> =BMI kg/m<sup>2</sup>.** According to specific chart (CDC growth charts) that was used to indicate the BMI according to age (CDC, 2000)<sup>(16)</sup>. The values of nutritional indicators were compared with international reference values, using CDC growth charts (Center for Disease Control and Prevention 2000). Data processing and analysis were carried out using SPSS (version 12).

## RESULTS

**Table (1)** demonstrates the mean values and standard deviations of oral cleanliness (plaque and calculus indices) and gingival index, among tonsillectomies children and control groups. Concerning plaque index, the tonsillectomies children showed the higher score and record nearly double value while the control group exhibited the lower value. Statistically highly significant differences were noticed between the two groups (P <0.05). Gingival index, mean value was higher in the tonsillectomies group, while the lowest value was among the control group. Also high significant differences were noticed between the two groups (P <0.05). Regarding calculus index, more calculus was recorded for the tonsillectomies children than the control group, differences were statistically significant (P<0.05).

The mean concentration values of salivary immunoglobulins (IgG & IgM) among tonsillectomies children and the control groups as seen in **Table (2)**. The low IgG value was represented in the saliva of the tonsillectomies group, followed by the control. Difference between the two groups was statistically highly significant Table (2). Regarding salivary IgM, the same result, control group comprised the high mean value of IgM while the lowest value cited in the tonsillectomies group with statistically marginal significant  $P= 0.054$ .

**Table (3)** demonstrates the distribution of body mass index, (numbers and percentage) among study and control groups. Results showed that the normal weight children were higher and recorded high percentage among control than the tonsillectomies group. Also the same table illustrates that tonsillectomies children exhibited the high percentage of overweight, while the opposite was true for the control group. Also the results of the study demonstrated that tonsillectomies children exhibited less percentage of weight less than normal (underweight) than the control children.

**Table (4)**, shows the correlations coefficients between plaque index and calculus index with gingival index among the two groups. A strong and positive statistically highly significant correlation was existed between plaque index with gingival index in the tonsillectomies children. The same table illustrates a positive statistically highly significant correlation was existed between plaque index with gingival index in the control group. Positive and highly significant correlation was noticed between calculus index with gingival index among tonsillectomies group. However, a weak and non significant correlation was recorded between calculus index with gingival index in the control group ( $P >0.05$ ).

**Table (5)**, shows the correlations coefficients between plaque index and gingival index in addition to calculus index with salivary immunoglobulin M (IgM), among tonsillectomies children and control groups. Among the two groups, a non significant correlations were recorded with salivary immunoglobulin M ( $P >0.05$ ). The same table shows a negative correlations were obtained with oral cleanliness in the relation to salivary immunoglobulin M (IgM), among the both groups.

**Table (6)**, shows the correlations coefficients between plaque index and gingival index in addition to calculus index with salivary immunoglobulin G (IgG), among the tonsillectomies children and control groups. Result from the table shows a negative highly significant correlations between salivary immunoglobulin G and all indices among tonsillectomies children ( $P <0.05$ ). In regard to control group, a negative significant correlations were obtained with plaque and gingival index, while the table shows a non significant correlation with calculus index.

**Table (7)**, shows the correlations coefficients between plaque index and gingival index with BMI among the tonsillectomies children and control groups. Result from the table shows a positive highly significant correlations between BMI with PII & GI indices among tonsillectomies and control children ( $P <0.05$ ). In regard to control group, a positive significant correlation was obtained with calculus index, while the result failed to reach significant correlation with calculus index among tonsillectomies children.

## DISCUSSION

In this study it was shown that patient who under tonsillectomy have a low level of IgG and IgM compared with healthy group, this could be the result of degenerative changes of the minor salivary glands (decrease in flow rate), or an inhibitory effect on the cells that produce the immunoglobulins or on the transport mechanism<sup>(17)</sup>. The finding of this study is in consistent with other studies found that a drop in serum and salivary immunoglobulin levels<sup>(18,19)</sup> in patients who have had a tonsillectomy, this may be also attributed to that, with a more or less rapid postoperative normalization of immune system among tonsillectomies children. The increase of immunoglobulin levels in serum and saliva in tonsillectomies children is also a common finding<sup>(20&21)</sup>. Some authors have presented studies in which humoral levels barely vary<sup>(20)</sup>. There are also *in vitro* studies that show an increase in the production of immunoglobulins following a tonsillectomy, meaning a stimulating effect on immunity<sup>(21)</sup>. These variations in the direction of correlation coefficient could be attributed to individual variations in relation to the immune system. The variation of the correlation between immunoglobulin and oral hygiene was also reported. In the study of Kerakawauchi, immunoglobulin in saliva found to be increased in patients with recurrent

tonsillitis, compared to patients with tonsillectomy<sup>(22)</sup>. These findings suggest that *S. pyogenes* is associated with the pathogenesis of recurrent tonsillitis and that immune responses against salivary immunoglobulin may play an important role in preventing the colonization of these bacteria in tonsils<sup>(22)</sup>. Serum-derived molecules, such as IgG and IgM have been found in saliva in this study in low level among tonsillectomies children, in spite of the fact that IgG increase with gingival inflammation, as a result of leakage of these components into the oral cavity because of the loss of the barrier function of the epithelium<sup>(4)</sup>, this low level among tonsillectomies patient as a result of impairing the normal function of the human immune system by tonsillectomy which can cause major alterations in the oral defense mechanisms that are likely to play a role in the decrease of salivary contents of immunoglobulins<sup>(7)</sup>. In this study it was shown that, the relationship was clearly negative between IgG in saliva with plaque, gingival in addition to calculus index among the tonsillectomies children and statistically highly significant, this negative relationship indicate that the high effect of tonsillectomy can inactivate the normal function of human immune system among this type of patients<sup>(23)</sup>. Also negative correlations were recorded in this study between IgM in saliva with plaque, gingival and calculus index among tonsillectomies children, but statistically failed to reach significance. This is difficult to explain, but it may be attributed to the mode of action of this type of immunoglobulin (IgM) which are regulators of host responses to infection, immune responses, and inflammation, and most of this immunoglobulin (IgM) unless produced in excess, act only locally over short distances<sup>(1&2)</sup> as show in the tonsillectomies children. Dental plaque is the main etiologial factor for gingival inflammation<sup>(3)</sup> In the present study, the plaque, calculus and gingival indices were higher among children under tonsillectomy than that among the control group; and the differences were highly significant, this could be explained by that the study group was having gingival index was correlated highly significantly with plaque and calculus index among tonsillectomies group and these correlations were strong in positive direction, this was in agreement with Zielnik-Jurkiewicz et al, this explained by the role of dental plaque as the primary etiologic agent in gingivitis<sup>(21)</sup>. Also one can suggest that the reduction in the immunoglobulin levels may diminish physical properties of saliva in tonsillectomies patients which in turn affect the severity of oral hygiene complications. Early dental intervention may significantly reduce oral complications associated with tonsillectomies patients. It is therefore crucial to evaluate the oral health surveys and to eliminate potential sources of infection in mouth among these patients concurrent with their medical therapy. Although the results from this study are not enough to state that the tonsillectomy do not modify the immune system, we think that a further study should be designed with large groups of same age and gender to see any differences between the patients undergoing tonsillectomy and normal subjects. Further studies need to comprise additional parameters which may affect oral health such as salivary tests, and advanced microbiological and genetic studies concerning oral hygiene. According to data of this study, it is clear that tonsillectomies children gained weight high percent compared with normal group. Similar to the results of available study, data by Jeyakumar et al<sup>(24)</sup>, they found that children gained weight after tonsillectomy. Nonetheless, they concluded that a large number of normal and overweight children gained a greater than expected amount of weight after tonsillectomy. Although it's widely believed that sudden increases in body mass index (BMI) following tonsillectomy<sup>(24)</sup>. This increases may also related with oral health condition. A study by Khader et al<sup>(25)</sup> showed that overweight individuals had double the incidence of periodontitis. A positive relationship between the body mass index (BMI) and periodontal disease was found in some studies<sup>(26,27,28)</sup>. Iraqi study of Mohammed<sup>(29)</sup> found that the mild gingivitis was the most predominant type of gingivitis among both overweight and normal weight. Al-Saddi<sup>(30)</sup> showed higher indices of periodontal disease with statistically significant differences among the groups of subjects with overweight than those with normal weight Ultimately, the available study is limited therefore, a well-designed prospective trial controlling among tonsillectomies children for caloric intake, eating habits, exercise, and lifestyle in addition to age, sex, ethnicity, and preoperative BMI% would help clarify this issue further.

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**Table 1:** Oral Cleanliness (Plaque and Calculus Indices) and Gingival index, Mean and Standard Deviation among Tonsillectomies Children and Control Groups

Oral Cleanliness	Tonsillectomies children	Control	Statistical test	
	(M±SD)	(M±SD)	t-test	P-value
PII	1.903±0.496	1.009± 0.544	6.645**	0.000
GI	1.499±0.330	0.797±0.424	7.144**	0.000

CaII	0.311±0.245	0.179±0.102	2.269*	0.027
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**Table 2 :** Salivary Immunoglobulin ( IgG&IgM) Mean and Standard Deviation among Tonsillectomies Children and Control Groups

Ig (mg/dl)	Tonsillectomies children	Control	Statistical test	
	(M±SD)	(M±SD)	t-test	P-value
IgG	294.947±115.789	394.873±173.251	2.627**	0.010
IgM	25.843±7.610	32.497±16.897	1.966*	0.054

**Table 3:** Body Mass Index (No & %) Among Tonsillectomies Children and Control Groups

Weight status		Tonsillectomies children		Controls	
		NO	%	NO	%
Body Mass Index	Underweight	2	6.6	3	10
	Normal weight	16	53.3	22	73.3
	Overweight	12	40	5	16.6

**Table (4):** Correlations Coefficients between Plaque Index and Calculus Index with Gingival Index among Study and Control Groups

Groups	PII		CaII	
	r	p-value	r	p-value
Tonsillectomies children	0.563**	0.001	0.639**	0.000
Control	0.9038**	0.000	0.227	0.228

**Table 5:** Correlation Coefficients Between Plaque Index , Calculus Index and Gingival Index , with IgM among Tonsillectomies Children and Control Groups

Groups	PII		GI		CaII	
	r	p-value	r	p-value	r	p-value
Tonsillectomies children	-0.300	0.108	-0.152	0.424	-0.306	0.100
Control	-0.225	0.232	-0.289	0.122	-0.024	0.901

**Table 6:** Correlation Coefficients Between Plaque Index , Calculus Index and Gingival Index with IgG among Tonsillectomies Children and Control Groups

Groups	PII		GI		CaII	
	r	p-value	r	p-value	r	p-value
Tonsillectomies children	-0.962**	0.000	-0.553**	0.002	-0.573**	0.001
Control	-0.880**	0.000	-0.895	0.000	-0.176	0.353

**Table (7):** Correlations Coefficients between Plaque Index, Calculus Index and Gingival Index with Body Mass Index among Tonsillectomies Children and Control Groups

	Weight	Oral hygiene
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Groups	status	PII		GI		Call	
		r	p	r	p	r	p
Tonsillectomies children	BMI	0.940**	0.000	0.519**	0.003	0.154	0.416
Control	BMI	0.963**	0.000	0.897**	0.000	0.639**	0.000

## بعض البروتينات المناعية في اللعاب وعلاقتها مع صحة الفم لدى اطفال اجريت لهم عملية رفع اللوزتين ومقارنتهم باطفال اصحاء

ان تأثيرات عملية رفع اللوزتين تشمل خلل في البروتينات اللعابية والمناعية بالإضافة إلى مضاعفات لانسجة الفم والاسنان. من اهداف هذه الدراسة هو احتساب ظهور التهاب الأنسجة ما حول الاسنان لدى اطفال اجريت لهم عملية رفع اللوزتين ومقارنتهم باطفال بنفس العمر اصحاء غير مصابين. شمل البحث (30) طفلاً اجريت لهم عملية رفع اللوزتين تتراوح أعمارهم بين (8-10) عام , وكذلك (30) طفلاً أصحاء لتمثيل مجموعة المقارنة. شملت الفحوص السريرية إحتساب دالة مقياس إلتهاب اللثة (GI) ، ألفيحة الجرثومية (PII) ، والترسبات الكلسية (القلح) (Call). جمعت العينات اللعابية المحفزة لكل طفل لتحديد عدد من البروتينات اللعابية و لتحديد عوامل الارتباط مع صحة الفم والتهاب اللثة. اظهرت الدراسة ان مؤشرات دالة مقياس إلتهاب اللثة ، ألفيحة الجرثومية والترسبات الكلسية (القلح) كانت أعلى عند المجموعة التي اجريت لهم عملية رفع اللوزتين مقارنة بالأطفال الأصحاء. اما فيما يتعلق بالجهاز المناعي في اللعاب , أظهرت النتائج ايضاً قلة في تركيز المستضد IgG & IgM عند المجموعة المصابة مقارنة مع المجموعة الضابطة , سجلت ضمن نتائج الدراسة علاقة معنوية بين مكونات اللعاب المناعية وصحة الفم والتهاب اللثة في هذه الدراسة عند الاطفال المفحوصين .

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