

Adenoids, Friends or Foes?

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Introduction

Adenoids are a mass of lymphatic tissue located within the nasopharynx. It has been shown that adenoids play a key role in respiratory and ear infection during childhood and adenoidectomy could improve these symptoms¹. The main goal of the present study was to evaluate the role played by adenoid colonization with bacterial biofilms and the incidence of recurrent infections within a pediatric population.

Material and Methods

Nasal and pharyngeal tonsils swabs as well as biopsies of pharyngeal tonsils tissue were collected from 62 participants in a prospective observational study with ages from 1 to 12 years old subject to adenoidectomy by either infectious or non-infectious indications. Bacteria identification was performed as previously described².

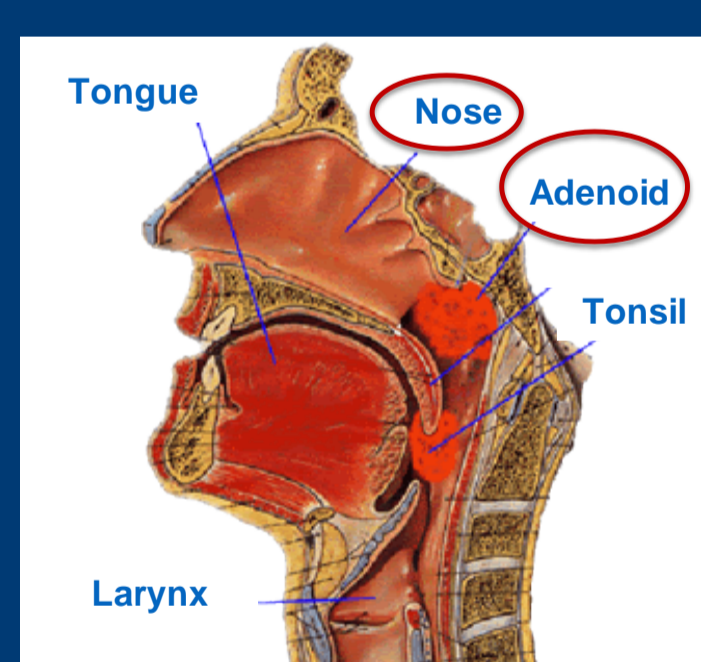


Figure 1. Sample collection.

Swabs from the nose and adenoid surface were collected. Adenoid biopsies were collected for both microbiology and electron microscopy analysis.

The presence of biofilms on adenoidal surface was assessed by scanning electron microscopy (SEM). Biofilm assembly assay ability *in vitro* was evaluated by the microtiter-plate test³. The assay was performed at 37°C in Muller-Hinton broth for 48h. Antibiotic susceptibility test was performed as described previously for all bacteria except *H. influenzae*⁵. For this bacterium antibiotic susceptibility test and capsular type were determined as described by before⁶.

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Results and Discussion

Microbiota

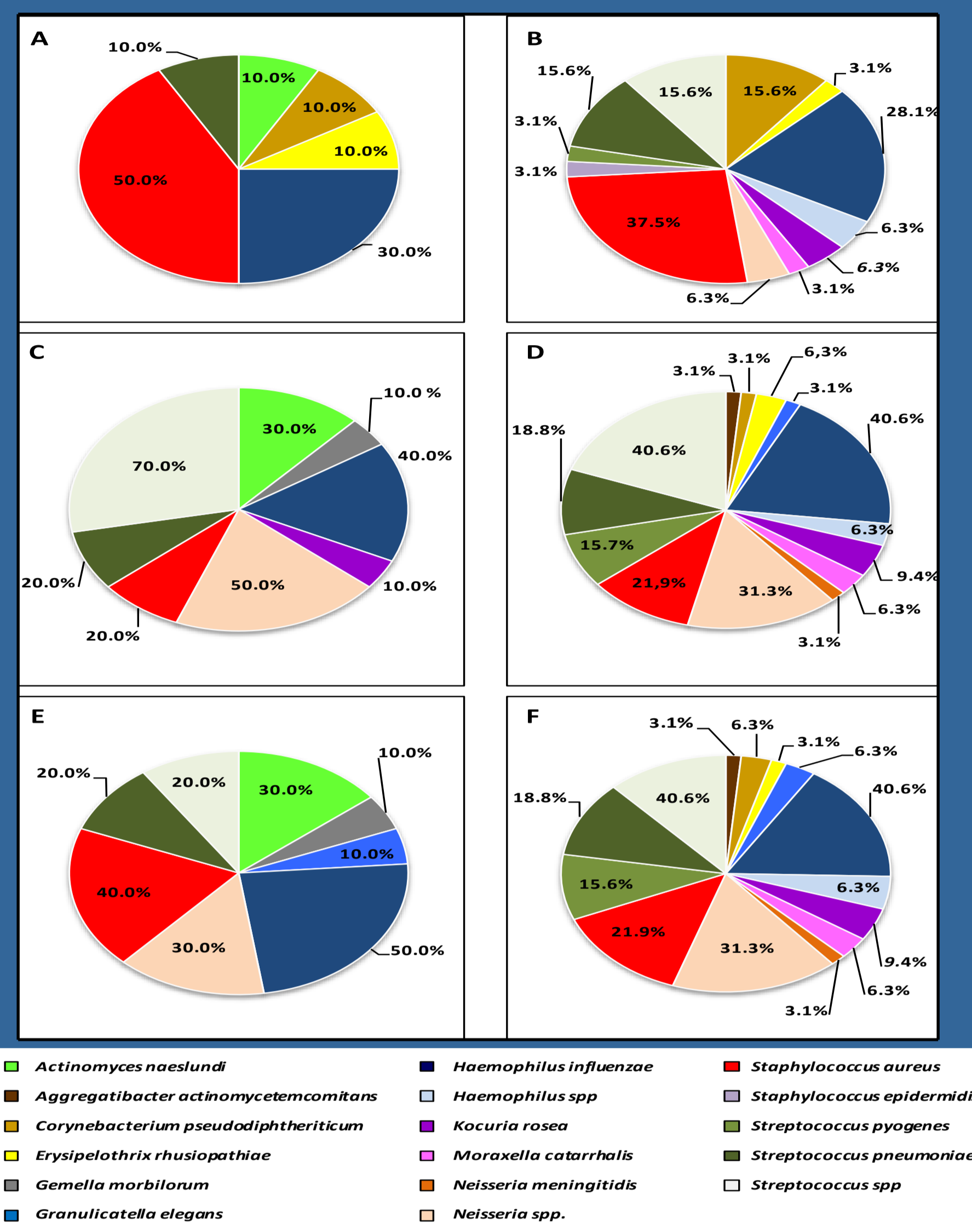


Figure 1. Microbiota. The nasal, adenoid surface and core microbiota are shown in figures A, C and E for group 1 (infectious), respectively. In figures 3.B, D, F is shown the microbiota of nasal, adenoid surface and core of group 2 (non-infectious).

The microbiota isolated from patients with both infectious (Fig 1.A, C and E) and non infectious surgery indications (Fig 1. B, D and F) was diverse including bacteria from 33 different genera. *Haemophilus*, *Neisseria*, *Streptococcus* and *Staphylococcus* were the most frequent.

Biofilms *in vivo*

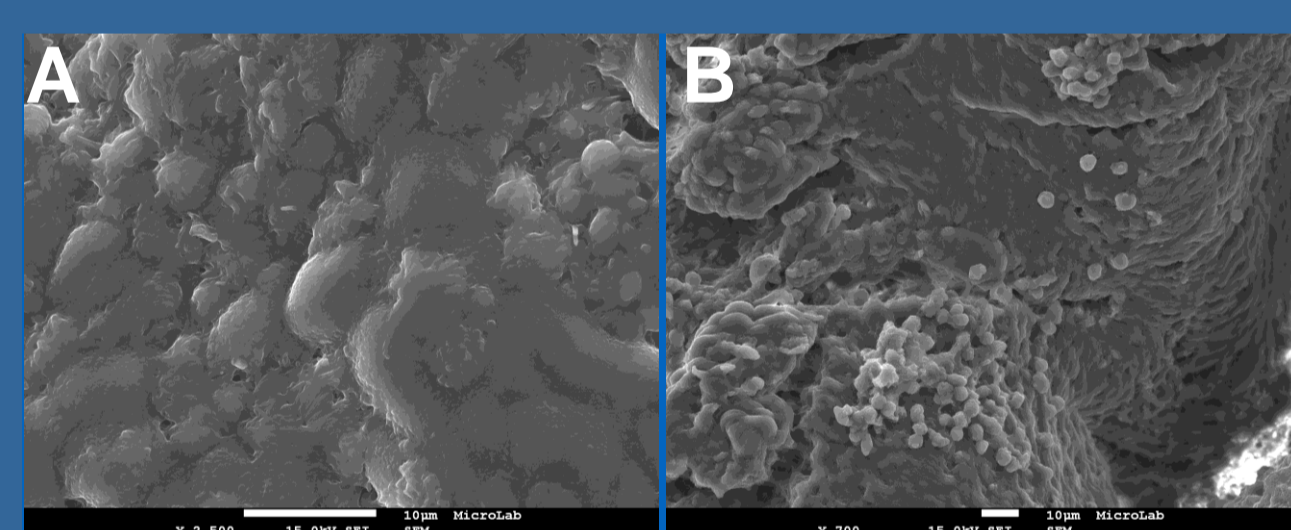


Figure 2. Biofilms assembled on adenoid surface.

Samples without (A) or with (B) biofilms on adenoid surface are shown.

SEM analysis revealed the presence of biofilms in 27% of the adenoid biopsies.

Biofilm assembly *in vitro*

H. influenzae (24), *S. aureus* (12), *S. pneumoniae* (10), *S. pyogenes* (8) and *M. catharrhalis* (2) isolated simultaneously on adenoid surface and core were ranked for biofilm assembly according to Stepanovic and colleagues⁴.

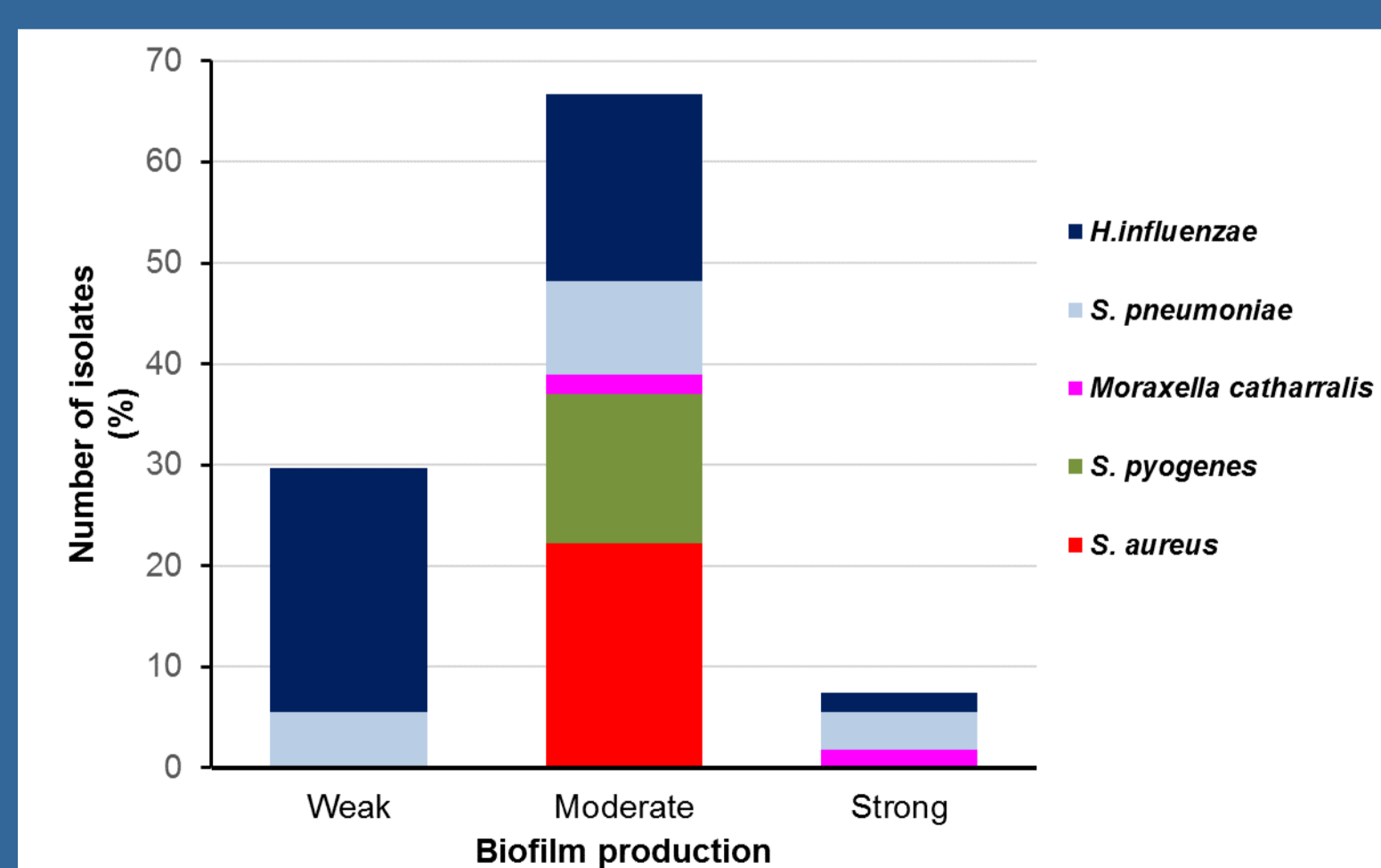


Figure 3. Ranking of biofilm assemblers *in vitro*.

No direct relation between the ability to assemble biofilms *in vitro* and the presence of biofilms on the adenoid (biofilm *in vivo*) was found.

Final Remarks:

The obtained results support the existence of bacterial biofilms on the adenoidal surface. This fact together with the existence of an identity between bacteria on adenoid surface and core only in the group of patients with infectious indication for adenoidectomy supports the hypothesis that adenoids can function as reservoirs of potentially pathogenic bacteria. Nevertheless, more work must be developed to unequivocally support this thesis.

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Antibiotic susceptibility

Bacteria	Antibiotic										Sample		
	Benzylpenicillin	Ampicillin	Amoxicillin	AmoxyClav	Cefuroxime	Cefoxitine	Cefotaxime	Ceftazoxime	Ceftazidime	Clindamycin	Origin	ID	Biofilm
<i>H. influenzae</i>	---	S	---	S	I	---	S	---	---	---	Surf	S3	-
	---	S	---	S	I	---	S	---	---	---	Core		
	---	S	---	S	I	---	S	---	---	---	Surf	S7	-
	---	S	---	S	I	---	S	---	---	---	Core		
	---	R	---	S	I	---	S	---	---	---	Surf	S39	-
	---	R	---	S	I	---	S	---	---	---	Core		
	---	S	---	S	I	---	S	---	---	---	Surf	S41	-
	---	S	---	S	R	---	S	---	---	---	Core		
	---	S	---	S	I	---	S	---	---	---	Surf	S45	-
	---	S	---	S	I	---	S	---	---	---	Core		
	S	S	---	R	S	S	---	---	---	---	Surf	S46	-
	---	S	---	S	I	---	S	---	---	---	Core		
	---	S	---	S	I	---	S	---	---	---	Surf	S55	-
	---	S	---	S	I	---	S	---	---	---	Core		
<i>S. aureus</i>	S	---	S	S	S	---	S	---	S	Surf	S35	-	
	S	---	S	S	S	---	S	---	S	Core			
	S	---	R	S	S	S	---	S	---	S	Surf	S39	-
	S	---	R	S	S	S	---	S	---	R	Core		
	S	---	S	S	S	S	---	S	---	S	Surf	S40	+
	S	---	S	S	S	S	---	S	---	S	Core		
	S	---	R	S	S	S	---	S	---	S	Surf	S46	-
	S	---	R	S	S	S	---	S	---	S	Core		
	S	---	R	S	S	S	---	S	---	S	Surf	S47	-
	S	---	R	S	S	S	---	S	---	S	Core		
	S	---	R	S	S	S	---	S	---	S	Surf	S51	+
	S	---	R	S	S	S	---	S	---	S	Core		
	<i>S. pneumoniae</i>	R	R	---	---	R	R	R	R	S	Surf	S40	+
		R	R	---	---	R	R	R	R	R	Core		
S		---	---	---	S	S	S	S	S	Surf	S45	-	
S		---	---	---	S	S	S	S	S	Core			
I		S	---	---	I	S	S	S	S	Surf	S48	-	
I		S	---	---	I	S	S	S	S	Core			
R		R	---	---	R	S	R	S	S	Surf	S50	-	
I		S	---	---	I	S	S	S	S	Core			
<i>S. pyogenes</i>	I	R	---	---	I	I	I	R	S	Surf	S51	+	
	R	R	---	---	R	I	I	R	S	Core			
	S	---	---	---	S	S	S	---	S	Surf	S16	-	
	S	---	---	---	S	S	S	---	S	Core			
	S	---	---	---	S	S	S	---	S	Surf	S32	-	
	S	---	---	---	S	S	S	---	S	Core			
	S	---	---	---	S	S	S	---	S	Surf	S63	+	
<i>M. catharrhalis</i>	S	---	---	---	S	S	S	---	S	Surf	S67	+	
	S	---	---	---	S	S	S	---	S	Core			
	---	---	---	S	R	---	S	S	---	---	Surf	S63	+
	---	---	---	S	R	---	S	I	---	---	Core		

Table 1. Antibiotic susceptibility.

Susceptible (S), resistant (R), intermediate (I). The strains were isolated from the adenoid surface (Surf) or core. Biofilm present (+) or not (-) on the adenoid surface.

The majority of bacteria were antibiotic susceptible independently of its origin (sample with or without biofilms). This result might be explained at least partially, by the nature of the sample since the adenoidectomy can only be performed in individuals without infection.

H. influenzae: virulence factors

H. influenzae, the most isolated bacterium, is an opportunistic pathogen, highly adapted to colonize the upper respiratory tract and easily progresses to infection, especially in children. For this reason, virulence factors such as the capsular type were investigated by PCR. However, all strains were characterized as non-capsulated, which might explain adenoid colonization and biofilm formation, as have been also described in the literature.