

Ilze Dobele

RHINOSINUSITIS RISK FACTORS IN DENTISTRY— CLINICAL ASPECTS

Summary of Doctoral Thesis
for obtaining the degree of a Doctor of Medicine

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LIST OF ABBREVIATIONS

A	artery
AR	allergic rhinitis
ARS	acute rhinosinusitis
CBCT	cone beam computed tomography
CI	confidence interval
COX	cyclooxygenase
CRP	C-reactive protein
CRS	chronic rhinosinusitis
CT	computed tomography
DPR	dental panoramic radiograph
EAO	European Association for Osseointegration
EPOS	European Position Paper on Rhinosinusitis and Nasal Polyps
ESR	erythrocyte sedimentation rate
N	nerve
OMC	osteomeatal complex
RS	Rhinosinusitis
RSU	Rīga Stradiņš University
SD	standard deviation
SL	Sinus Lift
V	vein
VAS	visual analogue scale

INTRODUCTION

The teeth are essential part of the alimentary system, and to chew food completely, at least ten teeth contact is necessary. Loss of the teeth results in atrophy (wear) of maxilla (Enlow, 1968), increase of load on the other teeth and loss of aesthetic function. Loss of teeth is caused by caries, periodontal disease, maxillofacial injuries and genetic anodontia. Since the first experimental descriptions of osseointegration (*Brånemark et al.*, 1969; Schroeder et al., 1981), clinical trials have shown convincing evidence that dental implants provide long-term support for removable and fixed dental prostheses. In general, patients are highly satisfied with the results of dental implant therapy (Adell et al., 1981; Buser et al., 1997; Lindh et al., 1998; Pjetursson et al., 2008).

Implants may be used both as a support for crown as replacement of a single tooth and a bridge as replacement of several teeth, and even for a dental prosthesis. Studies demonstrate that dental implants are safe technique to replace missing teeth, and functional and aesthetic effect achieved by dental implants is similar to that provided by natural teeth (Boyne, 1993; Chiaspasco, 1994; Belser et al., 2004; Patel et al., 2008; Esposito, 2010). Placement of dental implants in the maxillary posterior area requires a certain volume of bone, in this area bone volume is frequently insufficient and therefore requires bone augmentation within the maxillary sinus. (Tan et al., 2008; Vogel et al., 2013).

Mechanical prerequisite for successful osseointegration of a dental implant is the primary stability of an implant provided by height of alveolar bone $\geq 4-5$ mm according to criteria adopted in practice. This size is defined as a threshold for one-stage or two-stage surgery (Fenner et al., 2009). Like any surgical procedure, SL can potentially cause complications. Most complications resolve without long-term consequences, but still there are complications resulting in the loss of an implant. Prevention of complications starts with

Careful planning of prosthetic procedure, considering individual anatomical features, general health condition, lifestyle risk factors, functional and aesthetic wishes of a patient (Betts & Melora, 1994; Van der Berg et al., 2000; Berghlundh et al., 2002; Higginbotton 2004; Chiapasco & Casentini et al., 2009).

Recent publications highlight that 40% cases of inflammation in unsuccessfully treated maxillary sinuses are caused by odontogenic infections, this proportion being significantly higher than historic data with only 10-12% cases (Bhattacharyya, 2009; Borneli et al., 2009; Arias-Armiya et al., 2010; Patel & Ferguson, 2012, Hoskinson et al., 2012). Identification of odontogenic infections as a cause of maxillary sinusitis is difficult if evaluation is performed by intraoral radiograph and dental evaluation, whereas CBCT provides more detailed picture of the association of maxillary posterior teeth pathology and maxillary sinusitis (Bremke et al., 2009; Nair U.P. & Nair M.K., 2010; Mailet et al., 2011; Benavides et al., 2012).

Topicality of the study

Demand for high-quality contemporary prosthetic dentistry services in Latvia has increased lately. Complete or partial lack of tooth is common clinical situation in dentistry practice. In society, missing teeth are generally considered a sign of aging; therefore, the problem affects social attractiveness of an individual and decreases health-related quality of life. Replacement of missing teeth with dental implants is becoming increasingly popular in contemporary dentistry. Studies demonstrate that dental implants are safe technique to replace missing teeth, and functional and aesthetic effect achieved by dental implants is similar to that provided by natural teeth (Jen et al., 1990;

Wallace & Froum, 2003; Wallace et al., 2005; Chiapasco et al., 2006; 2009; Nkenke & Stelzle, 2009; Del Fabro et al. 2013).

As popularity of dental implants increases and related procedures of sinus floor elevation and implantation of bone grafting biomaterials becomes increasingly common, knowledge of surgical anatomy of maxillary sinus and aetiology, diagnosis and treatment of maxillary diseases gains special importance. Dentistry procedures in the area of maxillary posterior teeth may be complicated by the location of the maxillary sinus, anatomical peculiarities and pathology. During the surgery, oroantral communication, maxillary sinusitis, displacement of foreign body, i.e., bone grafting material, into the cavity may occur (Zimblér et al., 1998; Regev et al., 1995; Strietzel, 2004; Chen et al., 2013).

Increase bone volume in the posterior tooth area, surgical intervention is necessary: maxillary sinus floor elevation and insertion of bone tissue and/or grafting materials, i.e., *Sinus Lift (SL)* (Tatum, 1986; Tatum et al., 1993; Esposito et al., 2014). The aim of the procedure is to provide volume of maxillary alveolar bone sufficient for insertion of dental implants, osseointegration and stability. *Sinus Consensus Conference* 1996 described augmentation of maxillary sinus floor as a safe procedure that has predictably good results in the increase of the height of alveolar bone (Jensen et al., 1998). In past four years, the number of *SL* procedures performed at the RSU Institute of Stomatology increases (Figure 1).

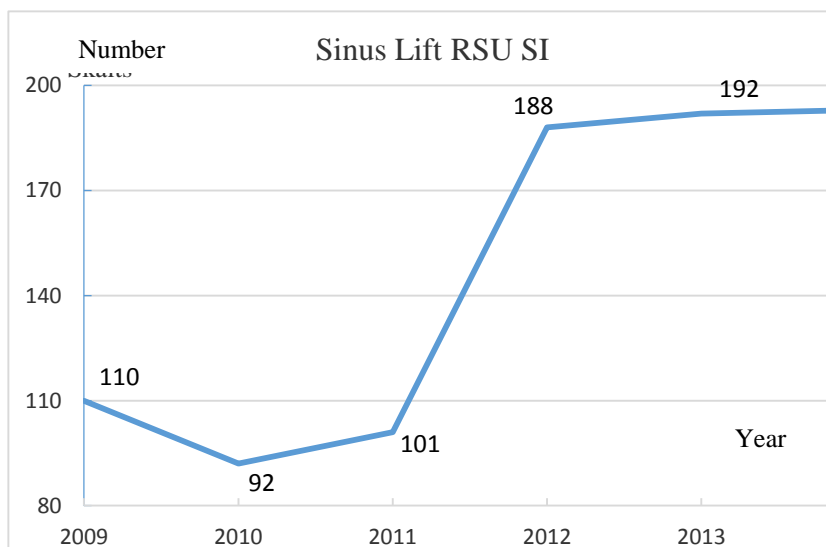


Figure 1. Change in number of SL procedures performed at the RSU Institute of Stomatology

The aim of the surgery is to restore biting function in patients with the resorption of maxillary alveolar bone and difficulties with functional dental prosthetics. Tatum was the first who in 1977 had presented modified Caldwell-Luck procedure with the lateral window approach in the lateral wall of maxillary sinus, lift of sinus floor and implantation of bone autograft in the space created between Schneiderian membrane and posterior wall of the sinus (Boyne&James 1980).

According to the literature, the most common complication of the procedure is membrane perforation, which can contribute to the development of rhinosinusitis and increase risk of loss of the augmentation material and the implant (Cho-Lee et al., 2010; Becker et al., 2008; Oh, 2011; Kim Y.K. et al., 2013). Various researchers have described development of sinusitis after sinus floor lift in 4–27% of cases, and sinusitis developed mainly in patients with

anatomical factors or pathological changes in the maxillary sinus prior to the surgery (Timmenga et al., 1997; Mardinger et al., 2010). In addition to evaluation of the thickness of bone tissue in inferior and lateral wall of the sinus, assessment of pneumatization and health of mucosa could be useful during planning stage of dental procedures in maxillary posterior teeth area. Evaluation of individual risk factors, i.e., general health condition, medicines used on a daily basis, unhealthy lifestyle factors, aesthetic and functional preferences, compliance for each patient and identification of symptoms related to pathology of nasal sinuses is especially important. Careful selection of patients and comprehensive pre-operative evaluation could result in decreased post-operative failure rate (Anavi, 2008). The literature contains various recommendations related to the preparation of patients before augmentation of maxillary sinus, but there is no comprehensive single algorithm for risk factor identification and its prevention prior to SL.

Novelty of the study

Risk factors assessment analysing radiological preoperative findings according to Lund-Mackay scoring system, and clinical nasal symptoms with VAS. Range the patients into the risk groups according to rhinosinusitis after combining radiological and clinical data together.

The novelty of the study is the development of clinical recommendations for otolaryngologists-prosthodontists, dentists, and maxillofacial surgeons. The guidelines could become a layout for SL patient examination and preparation prior to implantation with an aim to create support for maxillary prosthesis.

Determine the peculiarities of odontogenic sinusitis, and differentiate them from other sources of sinus infection.

The goal of the doctoral thesis

To determine the rhinosinusitis risk factors prior to Sinus Lift, grade the patients into the risk groups according to RS prognosis, as well as to evaluate clinical signs of odontogenic rhinosinusitis and informative value of CBCT in its diagnostics.

Objectives of the study

1. To perform retrospective analysis of maxillary sinus changes diagnosed by CBCT imaging of maxillofacial area prior to SL in dental patients.
2. Prospectively perform analysis of clinical and radiological signs of odontogenic maxillary sinusitis.
3. To develop a comprehensive patient information leaflet concerning *SL*, including information on the nature of procedure, risk factors, potential complications and alternative prosthetic techniques.
4. To develop diagnostic and treatment algorithm for *SL* patients with rhinosinusitis using the radiological Lund-Mackay grading system and clinical symptom assessment by VAS.
5. To develop clinical recommendations for examination of patients prior to *SL*.

Theses proposed for defence

Anatomical factors and pathological changes in maxillary sinuses are detected in the radiological maxillofacial images of dental patients.

Pathology of maxillary sinus, diagnosed prior to *SL*, is recommended to assess using radiological Lund-Mackay grading system and combined with clinical rhinosinusitis symptoms definite by VAS.

Maxillofacial CBCT is an informative technique for radiological diagnostics of odontogenic sinusitis.

Layout of the doctoral thesis

The doctoral thesis is written in Latvian. The doctoral thesis comprises the following sections: Introduction, Review of the Literature, Materials and Methods, Results, Discussion, Clinical Recommendations, and References. The total volume of the doctoral thesis is 95 pages (incl. appendices); analytical and informative material is summarised in 8 tables and illustrated by 30 figures; the doctoral thesis contains 6 appendices. References contain 272 titles used in the study.

Ethical aspects, study material and methods

The study has been approved by Ethical Committee of Rīga Stradiņš University (Decree No E-9 (2) /26.04.2012.). The study has been performed at Institute of Stomatology of Rīga Stradiņš University, Adenta, Ltd. and HC4, Ltd. Methods used in the study are included in the list of accredited and certified medicinal procedures, and have been performed on the certified equipment calibrated according to the ISO standards. Personal data of the subjects have not been included in any publication, report, or abstracts.

1. REVIEW OF THE LITERATURE

The goal of the review of the literature was to determine clinical and radiological signs of the odontogenic sinusitis, as well as complications and risk factors of the strengthening of the posterior part of maxillary sinus affecting the successful outcome of the manipulation, and the possibilities of the timely revealing and preventing of these factors.

Anatomical and clinical relation of maxillary sinus and a dental procedure has been described for the first time in medical literature by Nathaniel Highmore in 1651. He has reported a clinical case when after the extraction of a canine tooth, and maxillofacial communication has developed, and a purulent inflammation has occurred as a result of the entering of the infections contents of the periapical abscess into the maxillary sinus (Gibbs, 1913). Maxillary sinus has been known as an associated factor in the treatment of maxillary teeth for more than 350 years. In 1707, Cowper and Drake have begun to treat sinusitis by extracting posterior teeth to drain the maxillary sinus. This surgery has been used for purulent sinusitis for 200 years (Feldmann, 1998). The first morphological relation of the infected tooth and sinusitis has been proven by Bauer (Bauer, 1943). Due to the anatomical localisation, pathogens from periodontal tissue, periapical impairment, oroantral communication can enter nasal sinuses, orbital cavity, deep tissues of the throat, mediastinum (Sakamoto et al., 2000; Bagain et al., 2004; Brook, 2006; Mylonas et al., 2007).

Strengthening of the posterior part of maxillary sinus is a surgery with predictable positive outcome, and to perform it, both time-wise and financial contributions are necessary. The outcome of the treatment is influenced by the individual factors of a patient: general health condition, the number of missing teeth, maxillary bone volume and quality. The prognosis of the treatment is also affected by the used medicines, blood clotting impairments, diseases of the nasal

cavities, and smoking. During the radiologic examinations prior to SL, pathological changes and anatomical peculiarities are often found in the maxillary sinuses. The selection of suitable patients and teamwork of the specialists in the elaboration of the treatment plan are the prerequisites for the successful SL and placing the prosthetic support into the area of maxillary posterior teeth. The determining factors for achieving the positive outcome are technically precise performed surgery and healthy maxillary sinus.

In the case of recurrent, unsuccessfully treated rhinosinusitis, odontogenic cause, especially unilateral, must be excluded: nasal and/or nasopharyngeal discharge with foul odour and taste sensations. It is advised to ask patients about the manipulations performed in the area of maxillary posterior teeth, as well as to perform an appropriate radiologic examination – CBCT to the maxillofacial area, which would help in determining a possible odontogenic cause of the inflammation. As a result of summarising and analysis of the study results published in the literature, the risk factors have been divided into rhinogenic, dentoalveolar and common ones. The detailed division is described in Table 1.1.

Table 1.1

Risk factors for successful result of Sinus Lift

Rhinogenic	Dentoalveolar	Common
Rhinosinusitis	Complications after the extraction of maxillary posterior teeth	Uncontrolled diabetes mellitus
Allergic rhinitis	Unsuccessful history of inserting the implants on the side of the planned augmentation	Use of bisphosphonates

Table 1.1 (continued)

Septa, hypoplasia of the maxillary sinus	Uncontrolled periodontitis	Immunocompromised patients receiving corticosteroids, X-ray therapy in the region of the head and throat
Deformation of the walls of the maxillary sinuses after the Caldwell-Luc procedure or fractures of the facial bones on the side of the planned augmentation	Poor hygiene of the oral cavity	Smoking

Rhinosinusitis is one of the risk factors of the failures of implantation. In order to reduce complications of the manipulation, it is necessary to evaluate and explain the patient the clinical and radiologic signs of rhinosinusitis prior to the placing the implant and the SL.

The radiologic method of choice to determine the anatomical peculiarities of the maxillary sinus and to plan the surgical treatment is cone-beam computed tomography for the maxillofacial region (Guerrero et al., 2006, Harris et al., 2002, 2012; Kim M.J. et al., 2012). In order to assess the pathological changes, both radiologic and clinical examination of the maxillary sinus is necessary. Clinical monitoring of the symptoms of the nasal sinuses prior to the SL and, if needed, endoscopy and treatment of the nasal sinus and nasopharynx, is of crucial importance. The up-to-date evidence-based guidelines on the diagnostics and treatment of rhinosinusitis have been summarised in the EPOS 2012 document (Fokkens et al., 2012).

In order to improve the patients' quality of life related to oral health, clinical guidelines to identify the “healthy” maxillary sinus, as well as a comprehensive explanation for the patients regarding the necessity of the surgery, its nature, possible complications, and alternative prosthetic techniques are needed. Determining the risk factors for the SL prior to the planning of the

of implant surgery stage, it is possible to anticipate the result of the manipulation and reduce the post-operative complications.

Patients should be informed about the early signs of the SL complications:

- allergic reaction to any of the administered medicinal products and/or any of the bone substituting materials;
- throbbing pain in the region of the sinus affected by the surgery, would opening;
- pain, swelling on site of the surgery wound and/or in the cheek longer than 10 days;
- bleeding on site of the surgery wound and/or nosebleed when brushing teeth;
- pain, sensation of pressure on the side of the face affected by surgery;
- purulent, mucoid nasal discharge (on the side affected by surgery);
- mobility of the fixed denture;
- sensation of foul taste and/or odour.

Following the recommendations of the experts, introducing the principle of the evidence-based medicine into the drawing up of the patient examination model prior to the SL, bone-graft material and placing the implants for the support of the maxillary prostheses facilitates the qualitative interdisciplinary teamwork. Its aim is to improve the patients' quality of life related to oral health. Clinically monitored RS is not a contraindication for the strengthening of the posterior part of the maxilla.

2. MATERIAL AND METHODS

Work conducted two independent studies.

Retrospectively analysed data from RSU SI archives using data basis from SL patients.

In the recurrent RS patients group, endoscopic nasal examination has been performed; dental manipulations in the maxillary posterior teeth region and used medicaments have been identified. As for the radiologic examinations, CBCT of the maxillofacial region has been performed.

2.1. Examination of maxillary sinus by cone-beam computed tomography of the maxillofacial region

Retrospective study has been performed for the data analysis of the radiologic examination of the maxillary sinuses of dental patients. The examinations have been executed in the period of time from 2010 till 2011 at the Radiology Department of the RSU Clinic of Stomatology SIA using iCAT (*Imaging Sciences International, LLC*) computerised tomography (Fig. 2.1).



Fig. 2.1. iCAT (*Imaging Sciences International, LLC*) computerised tomography

In the study, the patients who had planned a surgery for elevation the maxillary sinus floor and inserting the bone-graft material for the implant placing for prosthesis support have been enrolled. The patients have been enrolled in the study without the analysis of the medical record data on their general health condition, used medicines and habits of smoking. In the period of the study, all of the patients have undergone the maxillary SL procedure.

CBCT examinations of the patients with partially managed CRS, who have been treated at the HC4, Ltd. from 2010 till 2014, have been analysed.

2.2. Description of the CBCT method

A cone-beam computed tomography equipment I-CAT[®] (*Imaging Sciences International, Hatfield, PA, USA*) have been used in the study. The scanning of the patients' maxilla has been performed for 8 to 9 seconds with voltage of 120 W and current of 5 mA. The images have been obtained using 0.3 voxel (volume elements of 3D imaging) values by means of CBCT reconstruction algorithm – 3DeXam Vision (KaVo Dental GmbH) programme with multidimensional reconstruction possibilities allowing visualising an image in coronal, sagittal and axial planes with 0.2 mm interval. Only those patients' images whose maxilla have been included completely, including whole sinus floor and OMC (Fig. 2.2), have been used for data processing.

In the coronal plane, mucosa and osteomeatal complex of the maxillary sinus floor have been assessed. All the measurements of the thickness of the mucosa (mm) have been performed normally to the posterior bone wall of the sinus, determining the maximal value and grouping in a MS Excel table for statistical processing (Fig. 2.3).

Osteomeatal complex (Fig. 2.4) has been assessed as open or closed in the coronal plane (Fig. 2.4).

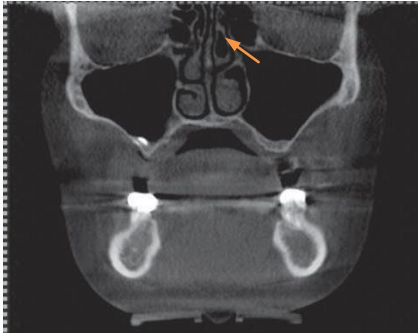


Fig. 2.2. Osteomeatal complex coronal plane of CBCT

The arrow indicates a natural orifice of the maxillary sinus

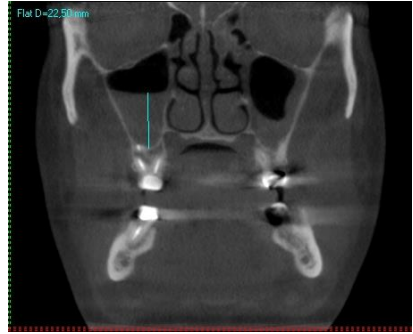


Fig. 2.3. Measurement of the thickness of mucosa of the maxillary sinus floor in the coronal plane

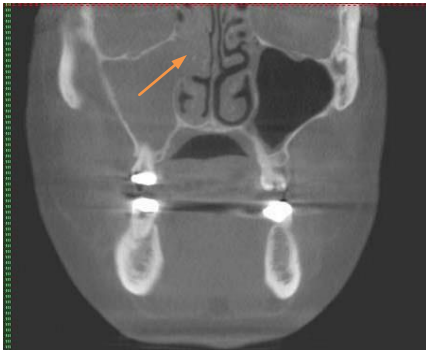


Fig. 2.4. Shadowed right maxillary sinus, coronal plane of CBCT

An arrow indicates a closed OMC of the right maxillary sinus

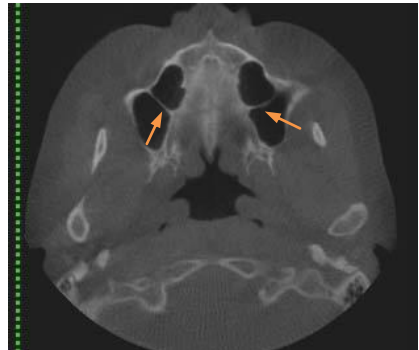


Fig. 2.5. Septa in the maxillary sinuses, axial plane of the CBCT

Septa are indicated by the arrows

The presence of septa has been assessed in axial plane (Fig. 2.5).

2.3. Characterisation of the patients examined radiologically

Sixty-eight CBCT images of the maxillary sinuses have been analysed retrospectively. 34 patients with partially missing teeth (16 females, 18 males) who have been examined radiologically prior to the SL surgery in the time period from 2010 till 2011 have been included in the group. Changes to the mucosa of the maxillary sinus, to the region of the natural orifice, and septa have been analysed in the examinations.

2.4. Characterisation of the patients examined radiologically and endoscopically

In the CRS group, CBCT of 17 patients who have been diagnosed with clinical signs of odontogenic maxillary sinusitis have been analysed. Changes to the mucosa of the maxillary sinus, to the OMC and maxillary posterior teeth area have been assessed. The age group of the patients with RS was 27 to 48 years of age, and included 9 females and 8 males. All the patients have been treated at HC4, at the otorhinolaryngologists within the frame of the study. None of the patients have been surgically treated regarding the nasal sinuses previously; they have not exhibited signs of allergy, and have had no medical history of chronic diseases of the lower respiratory airways or systemic diseases. None of the patients have used medicaments for the clinical management of chronic diseases. In RS patients group, nasal and nasopharyngeal endoscopy and CBCT of the maxillofacial region has been performed, as well as the history of dental manipulations in the area of maxillary posterior teeth has been identified.

2.5. Description of the endoscopic examination method

Nasal endoscopy has been performed in patients in the supine position with the head slightly turned into the direction of the examining physician. The patient is lying in supine position also during the surgery of the nose and nasal sinuses; in this manner, the field of view of the endoscopic examination is approximated to the anatomical structures and dimensions observed during the surgery. Rigid 4 mm diameter and 18 cm long endoscope HOPKINS® 30 (company Karl Storz, Germany) has been used during the examination. Endoscopy images have been obtained using endoscopic video system EVCS ED 420. The camera with OM adapter attached to the optics is shown in the Figure 2.6.

Nasal mucous membrane has been conditioned under the local anaesthesia with Lidocaini 10% spray. Nasal and nasopharyngeal endoscopy has been performed before and 10 minutes after the vasoconstriction of the nasal mucosa with *Sol. Xylomethazolini* 0.1%. Nasal cavity, middle meatus and nasopharynx have been observed. During the examination, nasal mucosa, discharges and anatomical peculiarities such as deviated nasal septum, pathologically concave or pneumatized nasal concha have been assessed.



Fig. 2.6. Video endoscopy system

2.6. Methods of statistical data processing

For the processing of the data obtained in the radiologic study, MS Excel data analysis programme has been used. To characterise the study groups, descriptive statistical methods have been used. Depending on the type of the variable, measures of central tendency have been calculated (arithmetic mean value), measure of dispersion (standard deviation), 95% confidence interval (CI), and limits.

2.7. Characterisation of the patient questionnaire prior to SL

A comprehensive explanation has been prepared for SL patients about the nature of the surgery, risk factors, possible complications, and alternative prosthetic techniques. Prior to the surgery, the patient reads the explanation, obtains the answers to the questions about the procedure, possible risk factors, post-operative regimen, control visits to the doctor (Appendix 1). The authors of the study have drawn up a questionnaire for the patients who had planned SL surgery for inserting the implants for prosthetic support of the maxilla, and have identified surgery risk factors of the treatment methods (Appendix 2). The patient answers nine YES/NO-type questions. If the patient answers YES to five questions he/she underlines clarifying information indicated in the questionnaire. The questionnaire records the answers on the demographic data of the patient, information on general health condition, signs of nasal sinusitis, medicaments used on daily basis, and smoking habits. Both electronic and printed questionnaires are available. In the patient's medical record, data on number of implants, their location, used bone-graft material and the type of anaesthesia indicated by healthcare professionals are recorded.

Detailed pre-operative examination of the patients and careful planning of the implant therapy reduces possible risks of complications. The plan of implant therapy is drawn up by analysing pre-operative possible risk factors,

general health condition, chronic diseases, used medicaments, smoking habits, as well as aesthetic preferences and compliance of each patient.

An informative description for patients regarding the post-operative regimen has been prepared, indicating nine dangerous complications of SL in the case of which an immediate consult with a physician is required. After the analysis of information available in the literature, an informative material for healthcare professionals regarding the “key points” of CBCT analysis for both pre-SL examinations and long-term evaluation of the results of the surgery has been prepared (Appendix 3).

3. RESULTS

3.1. Results of radiologic examination in the SL group

CBCT images of 34 patients have been assessed in SL study group: 16 females, 18 males, average age – 52.53 years (SD ± 9.15), age interval – 31 to 64 years. Patient age distribution is shown in Figure 3.1. Distribution of the results obtained from CBCT examinations of maxilla's of 68 patients is illustrated in Figure 3.2.

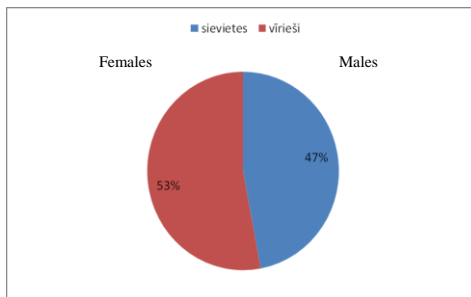


Fig. 3.1. Patient age distribution

The most frequent finding of the study was hyperplasia of the mucosa of maxillary sinus floor, which has been observed in 19 patients (in 33 sinuses) with CI9confidence interval from 0.3643 to 0.6062.

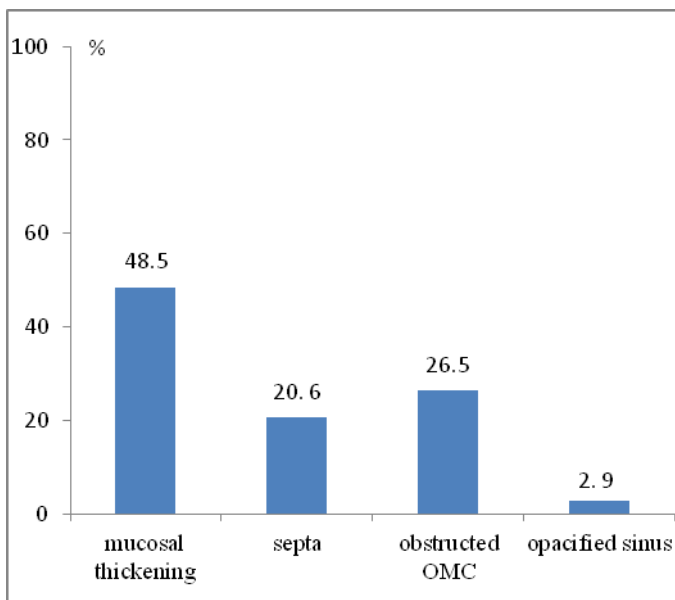


Fig. 3.2. **Graphic representation of the findings in the maxillary sinuses**

In fourteen patients, the hyperplasia has been found in the both, and in five patients – in one of the maxillary sinuses. Measurements of thickness of the mucosa show significant individual diversity from 2.3 mm to 12.9 mm. Mean thickness of the mucosa of the maxillary sinus floor was 6.23 ± 3.34 mm. Obstruction of the natural orifice of the sinus has been observed in 11 patients (in 18 sinuses), bilateral obstruction of the orifice – in 7, unilateral obstruction – in 4 patients. Septum has been found in 14 patients (in 14 sinuses), CI = 0.108–0.303. In two completely shadowed maxillary sinuses, oroantral communication after the tooth extraction has been found, CI = 0.11–0.70. Hyperplasia of mucosa of the maxillary sinus has been found in all the sinuses together with OMC obstruction. No differences in either age or gender groups have been found during the study.

3.2. Results of radiologic examination in the RS group

During the CBCT examinations, completely shadowed maxillary sinuses have been found in four, partially shadowed – in 5, and hyperplasia of the floor mucosa – in 8 patients. Assessment of the posterior teeth area has revealed: oroantral communication – in 3, foreign body in the maxillary sinuses – in 4, periapical highlighting – in 7, incomplete endodontic treatment – in 3 radiologic images (Fig. 3.3–3.7).

3.3. Results of clinical and endoscopic examination in the RS patient group

In the group of patients with rhinosinusitis, clinically difficult-to-manage CRS signs exacerbating, in average, 3–4 times per year, several years in a row, have been diagnosed. Seven days antibacterial treatment with *Caps. Amoxicillini/Clavulanate* 875/125 mg twice daily has improved the situation, although the signs of RS have periodically recurred with different extent of clinical severity. Clinical symptoms included continuous nasal and nasopharyngeal discharge; thirteen patients have exhibited unilateral symptoms; the discharge had a foul odour. Six patients have mentioned the signs of laboured nasal breathing. The history of the dental treatment has revealed the following: three patients have undergone maxillary tooth extraction, two – SL, three – inserting the implants, and eight – endodontic treatment of the maxillary posterior teeth.

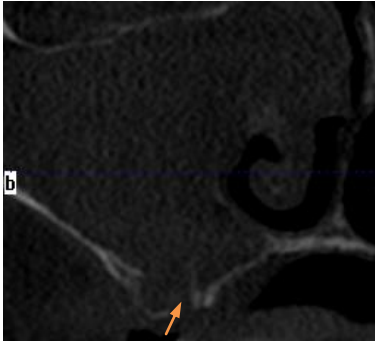


Fig. 3.3. Shadowed right maxillary sinus, coronal plane of CBCT

An arrow indicates communication with maxillary sinus

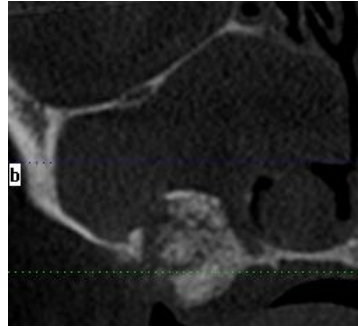


Fig. 3.4. Foreign body – augmentation material in the completely shadowed right maxillary sinus; coronal plane of CBCT

Right maxillary sinus, coronal plane of CBCT

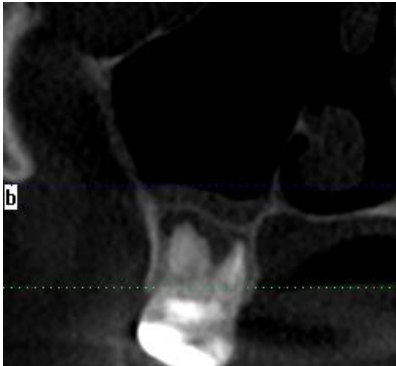


Fig. 3.5. Periapical highlighting around the root of 1.7 tooth, hyperplasia of mucosa of the maxillary sinus floor

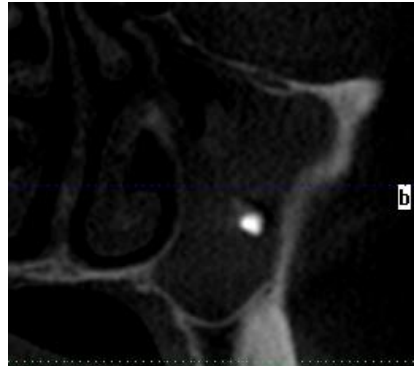


Fig. 3.6. Foreign body – endodontic material in the completely shadowed left maxillary sinus, coronal plane of CBCT



**Fig. 3.7. Implants in the maxillary sinus, hyperplasia of mucosa.
Sagittal plane of the CT**

During the endoscopic examination, in all patients, hyperaemia of the mucosa and purulent discharge in the middle meatus and in the nasopharynx has been found. According to the results of the CBCT examinations, the treatment plan for all the patients has been drawn up in cooperation with a dentist. On the basis of empirically most frequent pathogens of odontogenic infections, anaerobic and normal oral cavity microorganisms: aerobic – *Staphylococcus aureus*, *Streptococcus pneumoniae* and anaerobic – *Peptostreptococcus*, microorganisms of *Prevotella* species (Brook, 2010; Lechien et al., 2014), the patients have been administered with oral antibacterial therapy: Caps.*Amoxicillini/ Clavulanate* 875/125 mg twice daily for a week, and Tb. *Metronidazoli* 500 mg three times daily for 5 days. Three patients received an endodontic retreatment, and from the maxillary sinuses of three patients, a foreign body has been surgically removed.

3.4. Rhinosinusitis risk patients and risk detection methodology

The disease can be divided into MILD, MODERATE and SEVERE based on total severity visual analogue scale (VAS) score 0 to 10. To evaluate the total severity, the patient is asked to indicate on a VAS the answer to the question – how troublesome are your symptoms of rhinosinusitis. Scores increasing gradually, the assessment “0” means not troublesome, whereas “10” telling about worst thinkable troublesome nasal symptoms.

The Lund-Mackay staging system assigns the value of 0, 1, or 2 to each of the following sinuses: maxillary, anterior ethmoid, posterior ethmoid, frontal, and sphenoid.

Score assignments are 0 if the sinus is totally patent, 1 if the sinus is partially opacified, and 2 if the sinus is completely opacified.

The OMC is scored either 0 if patent or 2 if occluded. The maximum score for each side is thus 12, with a total score determined out of 24.

Analysing patients’ preoperative radiological findings were judged paranasal sinuses planned SL side. Summarizing the results of both analyses was established in risk groups’ distribution.

Table 3.4

Risk groups distribution

RS grade	VAS (grades)	Lund-Mackay score (grades)
Mild	0–3	0–1
Moderate	3–7	2–4
Severe	7–10	5–12

4. DISCUSSION

4.1. Clinical examination of maxillary sinus

Examination of the nasal sinuses, determining the cause of the disease and choosing the tactics of the treatment begins with detailed clinical examination – clarifying the symptoms of the disease and provoking factors. It is important to be aware of the history of allergic reactions, injuries and surgeries of the maxillofacial area, patient's general health condition, and chronic diseases, use of medicinal products, working and living conditions and unhealthy habits. CRS is mainly a clinical diagnosis (Settipane et al., 2013, Stuck et al., 2007). CT and endoscopy data approved this diagnosis, although the data correlation is not complete. Not all the changes in radiologic images can be associated with the diseases of nasal sinuses. Hyperplasia of the mucosa of the nasal sinuses, retention cysts can be found in the patients who do not exhibit clinical symptoms of RS. Radiological examinations rather correlate with endoscopic data than with clinical signs of the disease (Wittkopf et al., 2009). Changes found in the radiologic images feature the changes at the moment of performing an examination. In order to determine the diagnosis, changes of the CT must be interpreted considering clinical symptoms of the disease. Performing clinical examination of the maxillary sinus, it is important to determine the following nasal symptoms and their duration: laboured nasal breathing, nasal and nasopharyngeal discharge, impaired or loss of sense of smell. Rhinosinusitis is a multifactorial disease; that is why the factors that can affect the condition of mucosa of the upper respiratory airways of a patient must be identified. The aim of the treatment of chronic rhinosinusitis is to achieve clinical management if the disease. The severity of the disease is determined by VAS (Fokkens et al., 2012).

Clinical data are complemented and approved by the results of endoscopic and radiologic examinations. Special skills and equipment lacking in many healthcare practices is needed to perform endoscopic examinations.

Up-to-date radiologic examination of nasal sinuses cannot be imagined without a CT with reconstruction possibilities in different planes and the newest CBCT with 3D image diagnostics (Campbell et al., 2009). Primary examinations are performed to assess the anatomy of the bone tissues and to diagnose a possible pathology of the nasal sinuses prior to SL and inserting implants (Vogiatzi et al., 2014). In radiologic examinations, maxillary sinus is a hypodense, pyramidal and air-containing object occupying the maxillary bone almost completely; it has clearly traceable bone tissue margins. CT images are necessary both for the treatment planning and as a “roadmap” for a surgeon during the surgery. The most frequent findings are hyperplasia of Schneiderian membrane and septa. Analysing the changes found in 68 maxillary sinuses in the patient study group, these are hyperplasia of the mucosa, presence of septa, closed OMC, and even completely shadowed sinuses. In general, study data coincides with the investigations by other authors (Beaumont et al., 2005; Zijdeveld et al., 2008; Neugebauer et al., 2010; Ritter et al., 2011). It should be noted that during the routine examinations of dental patients, numerically significant changes in the maxillary sinuses are found. The results of CBCT examinations are important not just for the planning of SL, but also in assessment of dissemination of the pathology, as well as for the estimation of necessity of additional examinations and evaluation of post-operative results.

During the CBCT, pathologic changes in the maxillary sinuses are found in dental patients in 46.8–82 % (Janner et al., 2011; Ritter et al., 2011). Despite frequent the pathologies of the maxillary sinuses found in pre-SL radiologic examinations, clinics lack clearly defined internationally approved differences between the normal and pathological condition of the maxillary sinus. Several authors suggest expanding the field of view (FOV) of the examination by

including the whole maxillary sinus and its drainage pathways (Carmelli, 2010; Fatterpekar et al., 2008; Chan & Wang 2011; Jung et al., 2011). Analysing all the structures of the maxillary sinus in details, it is possible to obtain necessary information needed before performing SL. This conclusion is in agreement with the criteria described in the literature: dimensions and morphology of alveolar bone, condition of the teeth adjacent to the anticipated site of placing the implant, palatonasal angle, septa present in the sinus, localisation of the blood vessels, the condition of the mucosa and previous history of surgeries (Kobayashi et al., 2004; Lana et al., 2012).

4.2. Diagnostic aspects of odontogenic sinusitis

Due to the anatomical localisation of the maxillary sinus, it is associated with odontogenic infection more frequently than the other sinuses. During the enrolment of the patients in the study group it has been stated that the International Classification of Diseases ICD-10 does not content a separate diagnosis “odontogenic sinusitis”; that is why its actual prevalence in the group of RS of different aetiology cannot be determined. Up to 2006, epidemiological data are based on the data published in 1958: 10–12% (Brook, 2006). The most recent publication report that the historical data are based on the descriptions of anecdotal cases (Bomeli et al., 2009; Hoskison et al., 2012; Patel & Ferguson, 2012), and the number of odontogenic inflammation is much higher in reality. The identification of the wrong cause of the disease leads to unreasoned surgery of the nasal sinuses, repeated use of antibiotics and unnecessary tooth extractions (Legert et al., 2004; Rodrigues et al., 2009; Longhini et al., 2010).

In the patient study group, the endoscopic examination has not found differences between the findings of RS of different aetiology: purulent nasal and nasopharyngeal discharge, as well as mucosal oedema mostly in the middle

meatus. All the patients in the study group have indicated on the long-term unilateral nasal and/or nasopharyngeal discharge with a foul odour. All the patients have undergone dental manipulations in the area of maxillary posterior teeth during the last three years.

The signs of clinically “distinctive dental sinusitis” include recurrent RS episodes, unsuccessful treatment and unilateral sensation of foul odour and taste (Maloney & Doku, 1968; Legert et al., 2004; Mehra, 2004; Lee W.J., Lee S.J., 2010, Simuntis, 2014). Some authors consider that nasal breathing is not impaired in the case of odontogenic sinusitis as pathogenic aspects of the disease are not to be found in the middle meatus (Kretzschmar D.P.& Kretzschmar J.L., 2003).

Performing data analysis of 770 published articles on odontogenic sinusitis, Arias-Irmia et al. has concluded in 2010 that the most frequent cause of the maxillary sinusitis in this patients group has been tooth extraction and manipulations related to the inserting the implant. Several authors suggest all the RS patients to perform clinical and dental radiologic examination of the maxillary teeth and search for the highlights around the roots of the teeth – periapical infection (Bomeli et al., 2009; Longhini et al., 2012, Shanbhag et al., 2013). Small amount of patients – seventeen – have been enrolled in the study, although even in this little group, several causes of the odontogenic sinusitis described in the literature have been found – periapical infection, foreign body after the inserting the implant, endodontic treatment, SL and inserting the implant, traumatic extraction of the maxillary posterior tooth.

The diagnostics of odontogenic sinusitis cannot be imagined without radiologic examination; CBCT is an informative method for simultaneous assessing the condition of the maxillary sinus and the teeth, and the evaluation of dissemination of pathologic condition. In order to approve the suspected clinical odontogenic sinusitis, separate dental intraoral examination and the examinations of the nasal sinuses, or CT of the nasal sinuses without the dental

programme would not be necessary. A single examination would reduce the radiation dose and would comply with the internationally approved principle of ALARA (As Low As Reasonably Achievable), patient's time and expenses (Hendee & Edwards, 1986). The main advantages of the method are high resolution of the images and low radiation dose (Okano et al., 2009). The images allow informative evaluation of the pathology of the maxillary sinus and posterior lateral teeth and their possible mutual connection (Brüllmann et al., 2012). The advantage of CBCT in the assessment of endodontic treatment and diagnostics of RS has been described by the various authors (Nair U.P. & Nair M.K, 2010; Maillet et al., 2011; Shahbazian & Jacobs, 2012; Xu et al., 2012).

Results obtained within the frame of the study and in the literature give evidence that distinguishing features of clinically odontogenic sinusitis are recurrent episodes of RS which are briefly reduced by the applying antibacterial therapy; the symptoms are rather unilateral; the patients mention foul odour and taste of the nasal discharge. These patients are advised to clarify the history of dental manipulations in the maxillary area and to perform intraoral and radiologic examinations. CBCT that includes all the nasal sinuses is considered informative, as the assessment of maxillary sinus floor and the roots of the teeth only is insufficient. The results of the study and the literature data indicate the necessity of the cooperation between the dentists and otorhinolaryngologists in the field of diagnostics and treatment of odontogenic sinusitis.

4.3. Examination of SL patients prior to the surgery

At the Sinus Consensus Conference in 1996, the maxillary sinus floor augmentation has been described as “safe and predictable” manipulation of the alveolar bone augmentation in the atrophic maxilla, with the aim to restore the

physiological biting function (Jensen, 1996). Inserting the implants and planning of SL begins with the selecting the shape of the permanent prosthesis; the treatment is planned in the basis of the dentoalveolar condition of patients, their functional and aesthetic preferences, as well as financial capacity. Informed consent and comprehensive explanation regarding the aim of the surgery, its course and possible complications is the first step to the patient satisfaction with the outcome of the surgery. Prior to SL, all patients are advised to familiarise themselves with the comprehensive explanation, since as with every surgical manipulation, this method may also result in complications.

As medicaments affecting SL, bisphosphonates, drugs altering blood clotting, corticosteroids, immunosuppressants, and combinations of these products have been mentioned in the literature. In the created SL patients data base the use of these medicaments is identified.

“Healthy maxillary sinus” mentioned in the literature as one of the prerequisites to a successful SL is a non-specific term that requires clinically practical background. In radiologic images of the dental patients taken before inserting the implants both different anatomical variations and pathology are found. RS is a multifactorial disease, and its diagnostics is based on clinical symptoms approved by nasal endoscopy and radiologic examination. Yet no international guidelines which would specify the clinical significance of radiologic examinations and their association with patient's symptoms are available.

Torretta advises all the patients to perform CT of the nasal sinuses, nasal endoscopy, and to consult with an otolaryngologist prior to SL. In the case of pathology in the nasal sinuses, it should be treated prior to SL (Torretta et al., 2013). The questionnaire for New-York otolaryngologist with 63 respondents enrolled, contained an advice to all SL patients to perform CT for the nasal sinuses, and to those having had surgeries of the nasal sinuses, symptoms of

nasal sinusitis and/or allergic rhinitis to consult with an otolaryngologist (Cote et al., 2011).

Prior to SL, it is recommended to clarify the course and the nature of the procedure to the patient, to determine possible risk factors related to the disease of the nasal sinuses in the questionnaire and to perform CBCT for the maxillofacial area, including in the examination maxillary sinus in total. Optimal implant therapy is personalised, and drawing up the same treatment plan to every SL patient is impossible. Data analysis of the clinical questionnaires and CBCT helps identifying the individually required additional examination and the feasibility to consult with a specialist for every patient.

4.4. The significance of interdisciplinary cooperation in the examination and treatment of maxillary sinus

The localisation of the maxillary sinus and its anatomical association with maxillary teeth determined the cooperation of the physicians of different specialities. The extent of the manipulations performed in the maxillary sinus is versatile. Knowledge of clinical anatomy, being familiar with the manipulations performed in this area and their effect on the adjacent structures are the required features of both otolaryngologist and maxillofacial surgeon. If multiple specialists participate on the stage of the treatment planning, each is informed about the details of the specific clinical case, and if complications occur, the complete medical history should not be learned from scratch. The patient trusts the teamwork; on the contrary, compliance and trust can hardly be expected if in the case of complications the patient meets a specialist from the other field, whose knowledge regarding implant therapy or aetiology and pathogenesis of diseases of the nasal sinuses are minimal.

The role of an otorhinolaryngologist in the prosthetic dentistry is important not just in the treatment of post-implantation sinusitis, but also in the

planning of SL before the inserting the implant for the prosthetic support. Cooperation has different aspects, but the same goal: the achievement of predictably successful result. Each specialist has their own point of view on this problem. Usually, maxillofacial surgeon has no information on intranasal findings and a minimal experience in treatment the diseases of the nasal sinuses, but the interpretation of the dentoalveolar condition might be difficult for an otorhinolaryngologist.

Always bearing in mind that the patient has initially had consulted with the physician on the possibilities on the replacement of a missed tooth is important. The final goal of the prosthetic dentistry must be considered during all treatment procedures and examinations. In every case, there must be certainty that exactly implant therapy is the best prosthetic solution for a patient. A question whether information obtained on the stage of SL planning may affect the remaining of the implant at the implantation site, or this is side finding of radiologic or clinical examination which does not affect the outcome of the surgery. Patient's preferences are important, and whether these can be met, and what is the compliance (smoking, control visits, oral hygiene). Patients with odontogenic RS are more frequently referred to the otolaryngologist.

4.5. Algorithm of diagnostics and treatment of rhinosinusitis in Sinus Lift patients

CRS is a clinical diagnosis approved by endoscopic and radiologic examinations. Anatomical variations and different pathological variations of the maxillary sinuses, such as septa and hyperplasia of Schneiderian membrane are often found on CBCT. It is recommended to approve the relation of radiologic findings to clinical data by identifying clinical symptoms of sinuses and, in the

case of doubt, to consult with an otorhinolaryngologist. Algorithm of diagnostics and treatment of rhinosinusitis is shown in Figure 4.1.

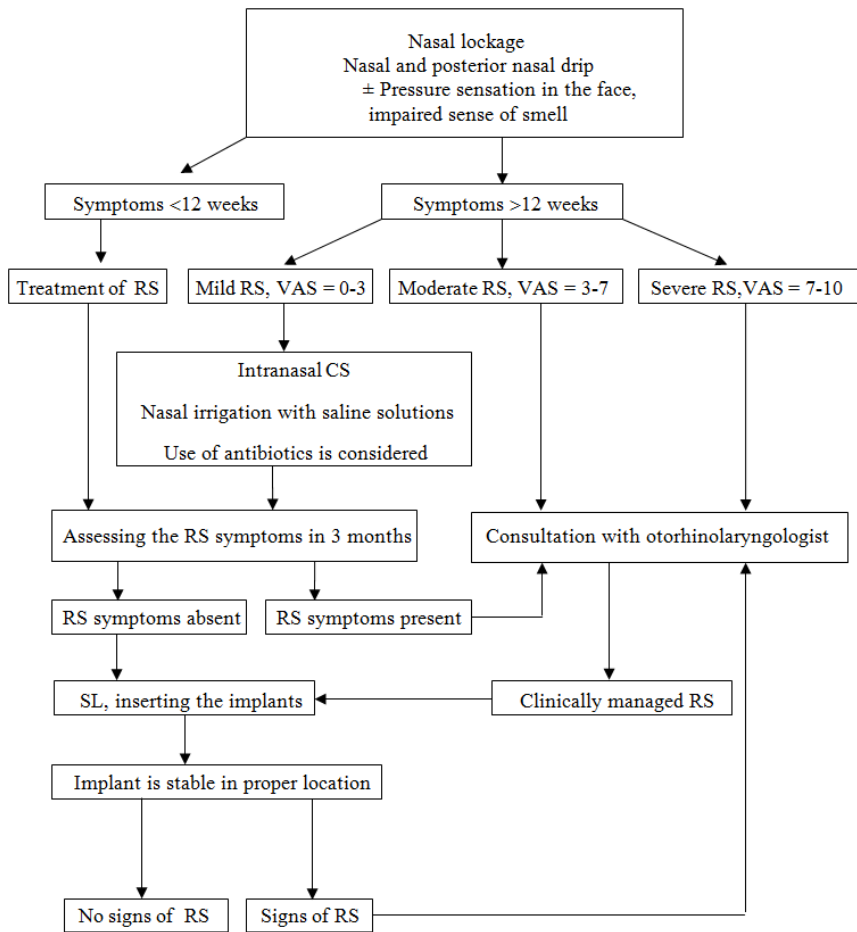


Figure 4.1. Algorithm of diagnostics and treatment of rhinosinusitis

5. CONCLUSIONS

1. As a result of the study, a working hypothesis has been approved: in CBCT images performed for the maxillofacial area of dental patients, different anatomical variations and pathology of the maxillary sinus are often found.
2. Clinical and radiological signs of odontogenic sinusitis identified in the study have proved the distinguishing symptoms: recurrent episodes of unilateral nasal sinusitis, usually accompanied by the nasal or nasopharyngeal discharge of foul odour, as well as with dental manipulations on the sinusitis side in anamnesis. Radiologic signs of odontogenic sinusitis are reduced periapical highlighting on the side of reduced sinus pneumatization, oroantral communication, foreign body – endodontic or augmentation material or an implant in the maxillary sinus.
3. As a result of the study, a comprehensive explanation of Sinus Lift has been created. It includes the description of the nature of the manipulation, possible complications and alternative treatment methods. This has been created as a tool of identifying the risk factors of SL prior to SL, raising the patient awareness, compliance and improving the patient quality of life related to oral health.
4. The algorithm for treatment and diagnostics of rhinosinusitis for Sinus Lift created for assessment the mutual correspondence of radiologic findings and clinical signs allowed a more targeted diagnostics and treatment of nasal sinuses diseases symptoms in SL patients.
5. Analysing patients' preoperative radiological findings were judged in the sinuses of planned SL side. Summarizing the results of both analyses was established in risk groups' distribution.

6. PRACTICAL RECOMMENDATIONS

The goal of the treatment guidelines is to draw the attention to the evidence-based methods of diagnostics, the possibilities of radiologic and endoscopic techniques of implantation for prosthetic support in the maxilla. Recommended algorithms for diagnostics and treatment, identifying the risk factors in the pre-SL period would provide an indicative direction for the necessity of the possible additional examinations.

CBCT that includes all the nasal sinuses, their drainage pathways, as well the possibility of three-dimensional assessment of the condition of the maxillary teeth, the quality and the quantity of alveolar bone is considered the informative method of radiologic examination of the maxillary sinus.

Analysis of data obtained during the clinical examinations, patient questioning and CBCT, individual planning of implant therapy and performing the necessary additional examinations contributes implants survival.

The results of the study had allowed emphasizing five practical recommendations:

1. Familiarise the patients with comprehensive explanation, possible complications and alternative possibilities of treatment prior to surgery.
2. Avoid surgery in the case of acute exacerbation of ARVI, CRS, AR.
3. Perform CBCT for the maxillofacial region prior to SL. Analyse patients' preoperative radiological findings using Lund-Mackay grading system. Summarizing the results of clinical and radiological analyses distributed patients in risk groups'. High risk group patients refer to the otorhinolaryngologist prior SL.
4. Identify and record data on patients' general health condition, symptoms of disease of the nasal sinuses, previous surgeries of maxillofacial and nasal sinuses, as well as used medicaments and smoking habits.

5. Patients having difficult-to-cure recurrent unilateral sinusitis are advised to clarify the history of dental manipulations performed in the area of maxillary posterior teeth, to perform intraoral and radiologic examination.

PERSPECTIVE OF THE STUDY

A data base of the patients who are going the SL surgery, where the patients' basic demographic data, information regarding the general health condition, medicaments used on daily basis, smoking, history of diseases of the paranasal sinuses, and symptoms in the period before SL can be a base for future studies analysing factors which affect implant survival.

Patients rhinosinusitis risk groups distribution promotes interdisciplinary team work between maxillofacial surgeons, prosthodontists, dentists and otolaryngologists.

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APPENDIX

Comprehensive explanation of the Sinus Lift surgery

SINUS LIFT

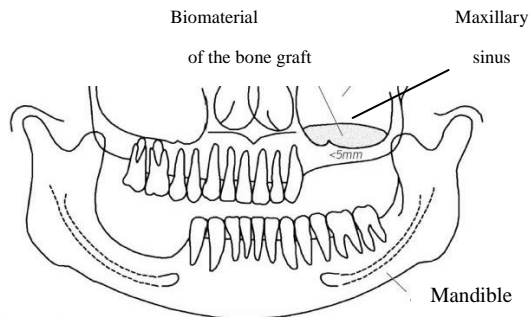
Comprehensive explanation

Dear patient!

The teeth are important part of the gastrointestinal system; to ensure the proper chewing the food, a contact of at least ten teeth is required. Loss of the teeth results in atrophy (wear) of maxillary bone, increase of load on the other teeth and loss of aesthetic function.

In modern dentistry, replacement of the missing teeth with implants becomes increasingly popular. The implants may be used both as a support for **crown** as a replacement of a single tooth and a **bridge** as replacement of several teeth, and even for a **dental prosthesis**. Studies demonstrate that dental implants are safe technique to replace missing teeth, and functional and aesthetic effect achieved by dental implants is similar to that provided by natural teeth.

If you have decided to replace the missing teeth with implants, a prosthodontist will discuss the treatment plan, risk factors and possible complications, as well as alternative prosthetic techniques with you. This explanation will prepare you for the conversation with the physician and will record the most important details of your health condition.



Schematic layout
of the jawbones and teeth

Why the surgery is necessary?

Clinical and radiologic examinations show that your maxillary bone volume is insufficient for inserting the implant(s). In order to support the bone tissue, a surgical intervention in the maxillary posterior teeth is required – inserting the bone tissue and/or materials to replace the bone tissue. The surgery is called **sinus lift** (SL).

What the patient should know?

The outcome of the treatment is affected by individual factors, such as general health condition, the number of the missing teeth, the volume and the quality of the jawbone. The treatment prognosis is also affected by the medicinal products you use, blood clotting impairments, disease of the nasal sinuses, and smoking. The smokers have an elevated risk to lose the implant due to the poor wound healing.

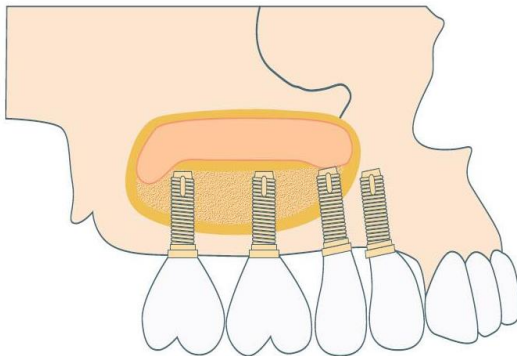
The doctor will explain you the things about diet, oral hygiene, tooth brushing, wearing a removable denture and post-operative regimen.

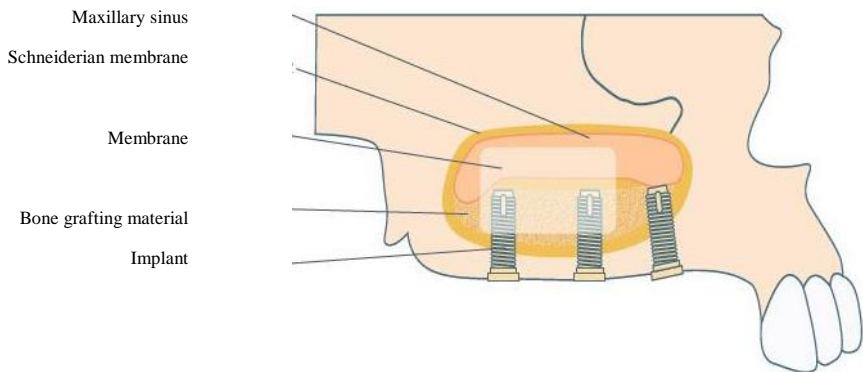
An alternative possibility to replace the missing teeth is a removable, or a bridge denture.

Who will perform the surgery?

The surgery is related to the adjacent maxillary sinus. The surgeon will perform a cut in the mucosa of the gums, the place where the implant(s) is intended to be placed, will open the sinus in the posterior wall and will place the bone tissue or its replacement material into the space between the mucosa of the maxillary sinus and the bone. The window shaped will be closed with a membrane secured by little titanium nails. The wound will be sutured.

Anticipated result – a denture resting on the implant(s) in the maxilla.

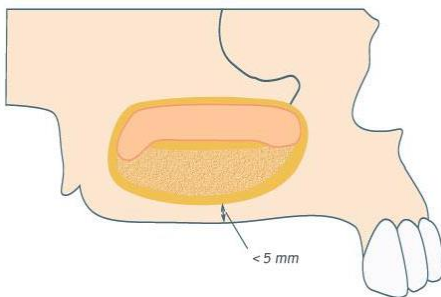




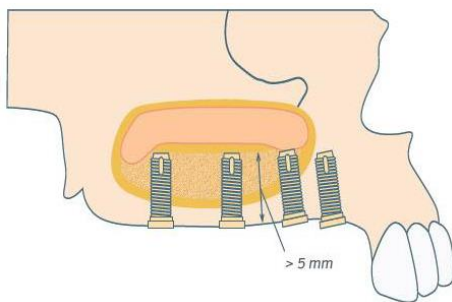
The surgery is planned

Depending on the amount of bone tissue required

- As one-staged – simultaneous **sinus lift** and inserting the implant(s) □



- As two-staged – sinus lift during the first,
 In 6 months, at the second stage – inserting the implant(s) □



Possible complications

If you have noticed any of the symptoms listed below please contact your doctor immediately regardless the date of the next planned visit!

Allergic reaction to any of the administered medications and/or any of the bone substituting materials

Pain, sensation of pressure on the side of the face affected by surgery

Throbbing pain in the region of the sinus affected by the surgery, would opening

Pain, swelling on site of the surgery wound and/or in the cheek longer than 10 days

Bleeding on site of the surgery wound and/or nosebleed when brushing teeth

Purulent, mucoid nasal discharge (on the side affected by surgery)

Sensation of foul taste and/or odour

Mobility of the fixed denture

Loss of the bone substituting material and/or loss of the implant

What a doctor should know?

In order to identify the risk factors of the prosthodontics, to reduce the possible complications and to plan the post-operative visits, please answer the questions in the questionnaire by circling the correct answer. This will help identifying the risk factors and reduces the effect their on the outcome of the surgery. In the case of doubts please ask your prosthodontist or surgeon who will be happy to help you! Your personal data will not be used in the publishing of the study. Thank you for your cooperation!

I have read and understand this document. During the conversation with the doctor, I have understood the importance of the replacing of my missed teeth and I have been explained the risk factors and possible complications, as well as signs when I must contact my physician immediately. I have had the opportunity to ask questions and I am satisfied with the explanations provided.

I give my consent to the surgery.

Date _____

Patient's signature / full name

Doctor's signature / full name

Questions to the patients prior to the SL surgery

Gender: female male

Age years old

Medical record No.

SINUS LIFT questions

Please answer the questions in the questionnaire by circling the correct answer. This will help identifying the risk factors and reduces the effect their on the outcome of the surgery. In the case of doubts please ask your prosthodontist or surgeon who will be happy to help you! Your personal data will not be used in the publishing of the study. Thank you for your cooperation!

Have you ever experienced an allergic reaction to medicaments?

Yes (please write down the medicinal products) _____

No

Have you been diagnosed with chronic diseases you regularly use medicaments to treat?

Yes (please write down the medicaments) _____

No

Do you have diabetes mellitus?

Yes (insulin-dependent / insulin-independent) _____

No

Have you ever taken bisphosphonates? (fosavance, melenor, risendros, ribidon, bonviva, ibadonic acid Teva, organand, aclasta, ossica)

Yes

No

Have you taken any of these medicaments during the last 6 months?

Antiaggregants – aspirin, clopidrogel (plavix), ticogrelol, blivik

Yes

No

Anticoagulants – varfarin, dabigatran (pradaxa), rivaroxaban (xarelto), apixaban (eliquiris)

Yes

No

Corticosteroids in the form of tablets or injections – prednisolone, medrol, dexamethasone etc.

Yes

No

Nasal sprays – Nasonex, Rhinocort, Flixonase, Dymista, Avamys

Yes

No

During the last 12 weeks, have you had any of the symptoms of the nasal sinusitis – nasal congestion, nasal/nasopharyngeal discharge, pressure sensation in the face, impairment of smell sensation?

Yes

No

Please evaluate the effect of the symptoms on your everyday life (absence from work and /or studies, sleeping disorders) after the visual analogue scale (VAS) in the range from 1 to 10

1 2 3 4 5 6 7 8 9 10

Not troublesome

Worst thinkable troublesome

Have you had surgeries of the nose or paranasal sinuses?

Yes (nasal septum surgery, nasal polyps surgery, maxillary sinus surgery, nasal turbinate surgery, functional endoscopic sinus surgery) please underline the name of the surgery (ies)

No

Do you smoke?

Yes _____ cigarettes per day, for _____ years

No

Patient's questions: _____

I have read and understand this document. During the conversation with the doctor, I have understood the importance of the replacing of my missed teeth and I have been explained the risk factors and possible complications, as well as signs when I must contact my doctor immediately. I have had the opportunity to ask questions and I am satisfied with the explanations provided.

I give my consent to the surgery.

Date _____

Patient's signature / full name

Doctor's signature / full name

CBCT CHECK LIST PRIOR TO SL

SL-CBCT examinations

Regardless the extent of the planned surgery and the quadrant where the implant will be placed, the following “control points” in the maxillary sinus are to be considered viewing the computed tomography images. Especially prior to the surgery, the surgeon should pay attention to the following things and questions:

Are the radiologic data are correct?

- Is the chosen window correct? If the window is too narrow, than all the necessary structures as well as pathological changes may not be included in the images.
- Is the zoom-factor correct? The surgeon will require maximum amount of information of good quality about the surgical field. Small images provide significantly less details.
- Do the images include relevant anatomical structures – lateral image?
- Are the plane and the layer thickness correct on the chosen image? Coronal, axial, sagittal plane, reconstructions?
- Are the right and left sides marked correctly? It still happens, and everybody knows that, that, especially in coronal plane, right/left sides might be marked wrong. This must be checked regarding the nasal septum deviation, history of previous surgeries and dental fillings. (Important fact that can cause medically legal consequences!).
- Data of examination? Is the situation observed in the images is sufficiently up-to-date, or it might be changed due to a disease, tooth extraction, injuries or other factors that require new information?

Is there a correlation between the patient’s clinical information, medical history and the present radiologic images?

Not every opacification of the paranasal sinuses corresponds to rhinosinusitis? Retention cysts, hyperplasia of the mucosa can often be interpreted as “serious pathology” although the patient has no symptoms of the diseases of the nasal sinuses. Speaking of the inflammation processes in the nasal sinuses, it should be noticed that CBCT reflects the changes only at the moment when the examination is performed.

Quadrant planned for the inserting the implant?

- Is the bone volume sufficient? What are the dimensions of the alveolar bone – vertical of horizontal dimensions (mm) and density?
- Are there septa in the surgical field: how this can affect the performing of the manipulation and the position of placing the implant?
- The proximity of the adjacent teeth, infection, etc. If and how this can affect SL and placing the implant?
- Posterior margin – location of the blood vessels: can the upper alveolar artery be identified?
- Palatonasal angle: acute or wild?

Maxillary sinus

- Are bone wall margins clearly identified?
- Mucosa: is the sinus pneumatized? If the changes are observed, what is the thickness of the hyperplased mucosa, the volume of pathological contents; does it fill the whole sinus?

Drainage pathway: What is the configuration and location of the osteomeatal unit?

- Do Haller cells narrow infundibulum ethmoidale or has the maxillary sinus any additional orifices?
- What is the shape of nasal turbinates, is it pneumatized, or pathologically lateralized?

In the case of the disease of the nasal sinuses:

- Are the pathologic changes observed only in the maxillary sinus or any other nasal sinuses? This can be an evidence of chronic rhinosinusitis, polyposis of nasal sinuses.
- Are radiologic changes evaluated as of infectious nature, or MR is also required additionally for differential diagnostics of the mass? Is the disease clinically controlled? Are additional examinations and/or consultation with an otorhinolaryngologist is required?

In the case of the history of previous surgeries:

- Have SL been performed?
- Have maxillofacial injuries been experienced? Le-Fort I osteotomy?
- Have sinuses been subjected to surgeries: can bone tissue defects be observed in the wall of the sinus, inferior or middle nasal meatus?
- What has been done during the previous surgeries? Which structures have been changed, removed?
- Are you sure that after the present CT, no surgical manipulations have been performed (medically legal question)? Were there complications during previous surgeries or during the post-operative period? Can the signs of developing of cicatricial tissue of new bone tissue be observed in the images?