Endometriosis - Update of Therapeutic Management

Orthodontic Splint Treatment of Patients with Limited Bone Supply

Cystic Tumors of the Pancreas

Monstrous Thoracic Osteochondroma Case Report - Diagnosis and Therapy

診断及び治療

Endometriosis

アパラトの付着

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Germany takes a leading position in medicine.

German hospitals, clinics and medical doctors enjoy an excellent reputation. The continuously rising number of patients, who come to Germany to receive medical treatment and support, strongly confirms this fact.

Patients from the Gulf States gladly come to Germany to receive medical treatment because they regard Germany as a safe place and rely on German clinics and physicians. They feel welcome as guests and enjoy that they are encountered in an open-minded and friendly way.

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The Internet has opened up entirely new opportunities as the perfect medium for instant communication across the globe and for knowledge transfer. We realised this at a very early stage, publishing the first online issue of the German Medical Journal a whole decade ago. We are very proud that the German Medical Journal has taken on a two-fold pioneering role, being both a medical online journal from Germany and the voice of German medicine for a global readership.

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The journal thus also provides a valuable contribution to the global transfer of knowledge - an aspect that is near and dear to our hearts. Knowledge makes the world a better place.

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It is a common platform that brings together different segments of the health and medical industry to explore new opportunities, showcase the latest technologies, services and facilities, and leverage potential for trade and investment.

The Conference is aligned with the government’s Health Vision 2050 and aimed at addressing the challenges as well as discussing initiatives to improve the sector. It is the pioneer health and medical show in Oman and the only one certified by UFI-The Global Association of the Exhibition Industry. It is recognized as Oman’s biggest healthcare platform.
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Endometriosis - 
Update of Therapeutic Management

انتباذ بطانة الرحم:
تحديث الإجراءات العلاجية
Introduction

Endometriosis is one of the most common gynecological benign diseases in premenopausal women. It is diagnosed in approximately 6-10% of all women and in 35-50% in women with abdominal and pelvic pain or infertility. In Germany, about 40,000 cases of endometriosis are diagnosed per year, with almost 20,000 patients being evaluated in hospitals for further management [1]. Health care expenses for endometriosis are estimated to amount up to 22 billion USD.

Endometriosis is an estrogen-dependent disorder exhibiting endometrial glands and stroma outside the uterine cavity. Main symptoms are abdominal or pelvic pain and infertility. Due to still unknown etiology and pathogenesis of endometriosis, therapy focuses on symptom relief. Current standard therapy for endometriosis concentrates on surgery with complete resection of all endometriosis lesions, if possible, by laparoscopy. Following surgical treatment, further options include hormonal substitution and analgesia. Primary aim of hormonal therapy is to suppress and antagonize the estrogen production. Complementary Medicine and Alternative Therapies can be considered to improve symptoms, however randomized studies are lacking [2]. In this manuscript, current aspects for surgical and medical treatment of endometriosis are summarized.

General Considerations

Indications for laparoscopic evaluation in case of suspected endometriosis include pain, destruction of organs and/or sterility [3]. If a patient with endometriosis is asymptomatic and has no desire to have children, treatment is not necessary. As an exception to this rule, patients with impaired organ function (e.g. ureteral stenosis with consecutive hydronephrosis) due to endometriosis lesions may still require therapeutic interventions despite lack of clinical symptoms.

In the present manuscript, possible clinical presentations of endometriosis with their

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وتختص في مسودة الدراسة هذه
جوانب الحالات الجراحية والطبية
المتاحة لعلاج انتباذ الرحم.

اعتبارات عامة

دواعي التقييم بالتنظير البطني

الذي ينطبق على الأنتباذ الرحم في وجود انتباذ
الرحم يشمل تقييم الأمراض مثل الألم
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غير ضروري. ويتسم من هذه
الظاهرة المريضات ذات الاعتلال
ال居室 الطبي (مثل تقضي
الحالين مع استئناف كلي تابع له).

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related treatment options are discussed. Hormonal treatment options are described more detailed at the end of the manuscript.

**Peritoneal Endometriosis**

**Medical Treatment**

The primary aim of the hormonal treatment is to obtain a hypoestrogenic state by suppressing the ovarian function and achieving the regression of endometriosis implants. Treatment options including progestagens, continuous use of combined oral contraceptives and Gonadotropin-releasing hormone (GnRH) agonists effect the reduction of endometriosis-associated symptoms, fibroids and dysmenorrhea.

Each endometriosis patient has an individual treatment plan considering all symptoms, other diseases and patient’s wish. In case of no patient satisfaction, hysterectomy can be considered. When menorrhagia is the main symptom, we use GnRH analogues combined with oral contraceptives.Embolic therapy can be a good choice for deep infiltrating endometriosis. For diagnostic uncertainty, a laparoscopy can help.

**Surgical Treatment**

Surgical treatment is suitable for symptomatic endometriosis. Peritoneal endometriosis can be surgically treated by removing the implants and scar tissue. Ovarian endometriosis is surgical treated by removing implants and scar tissue. Deep infiltrating endometriosis is surgical treated by removing implants and scar tissue.

**Possible additional Treatments**

- Embolization
- MRI-guided focused Ultrasound Surgery (only within trials)
- Psychosomatic Care
- Complementary Medicine (e.g. Traditional Chinese Medicine, Acupuncture)

**Intraoperative Findings**

**Gynecologic Examination suspicious for Endometriosis**

- Pain
- Sterility
- Destruction of organs

**Suspected Endometriosis**

- Asymptomatic
- No desire for children

**No Therapy**

(Exception: Ureterstenosis)

**Diagnostic Laparoscopy for histologic evaluation**

**Peritoneal Endometriosis**

**Ovarian Endometrioma**

**Deep infiltrating Endometriosis**

**Adenomyosis uteri**

**Fig. 1: Endometriosis Treatment Algorithm, adapted from the National German Guideline of Endometriosis 2014 [3]**

**شامل 1: خوارزمية علاج انتباذ بطانة الرحم مقترحة من الدليل الإرشادي الألماني لانتباذ بطانة الرحم 2014 [3]**

- بسبب آفات بطانية رحمية مثبتة، فلا يلزم الحاجة إلى تدخلات علاجية رغم غياب الأعراض السيربية.
- ونتناقش في مسودةدراسة هذه الظهر السيربي لانتشار بطانية الرحم والخيارات العلاجية المتعلقة به. تم وصف الخيارات العلاجية بالتفصيل في نهاية الدراسة. 
- انبخاض بطانة الرحم الانتباذية الفوقية في حالة الشروط الأساسي من العلاج الهرموني هو الحصول على حالة من الأستروجين المتضنى عن طريق إدخام وظيفة المبيض. 
- الهرمونية بالتفصيل في نهاية مسودة الدراسة.
Dienogest was better tolerated than GnRH agonists and oral progestagen (Dienogest). Two current, prospective randomized trials regarding endometriosis-associated pain demonstrated a comparable outcome between GnRH agonists and Dienogest. Despite the frequent use in daily practice, a definite proof for positive effect of antirheumatic and antiphlogistic drugs on endometriosis-associated pain is missing [7].

Surgical Treatment
Primary aim is the completely removal of all endometriosis lesions by laparoscopy. This procedure may result in significant pain reduction [8]. In contrast, an equal effectivity of other different procedures like coagulation, vaporization or excision has not been proven so far [9, 10]. To further reduce pain following surgery, application of a levonorgestrel-releasing IUD can be considered [11].

Ovarian Endometrioma
Medical Treatment
Hormonal treatment alone can neither eliminate nor compensate an incomplete removal of ovarian endometrioma, so that hormonal treatment in ovarian endometrioma is not recommended [3].

Surgical Treatment
Most effective treatment of ovarian endometriomas is the surgical removal. In this context, complete resection of the cyst wall is warranted. In a meta-analysis, ovary-preserving cystectomy in comparison to thermic destruction of the cyst wall is more effective regarding pain relief, relapse and pregnancy rates [12]. Due high risk for relapse, only opening and flushing the ovarian endometrioma as a solely surgical procedure is not sufficient. In addition, postoperative treatment with GnRH agonists could not postoperatively balance the incomplete surgical resection [13].

Deep Infiltrating Endometriosis (DIE)
Medical Treatment
Benefits for pre- or postoperative GnRH agonists application in DIE is not proven and is therefore not generally recommended [13]. If patients refuse surgery or still suffer from pain following surgery, hormonal treatment is one option. As the effect of hormonal therapy is usually expected only during the treatment period, continuous application of this treatment is recommended.

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In conclusion, hormonal therapy is one option. As the effect of hormonal therapy is usually expected only during the treatment period, continuous application of this treatment is recommended.
Therapeutic options include continuous use of oral contraceptives, progestagen monotherapy and GnRH agonists (in continuous application with “add back” estrogen therapy for bone protection) leading to therapeutic amenorrhea. As an alternative treatment, positive effects of a levonorgestrel-releasing IUD regarding pain and lesion size in deep infiltrating endometriosis have been described [14].

**Surgical Treatment**

If possible, complete resection of endometriosis lesions should be achieved [3]. In this context, surgeries may include rectum resection (mostly en-bloc with the rectovaginal septum and the vagina), and partial resection of the sacrouterine ligament and/or parametria as well as partial bladder resection. Ureter resections with re-anastomosis (e.g. Psoas-hitch ureteroneocystostomy). Fig. 2: Intraoperative image of peritoneal endometriosis

![Fig. 2: Intraoperative image of peritoneal endometriosis](image)

After the surgical procedure, an experienced gynecologist is essential to ensure complete removal of endometriosis lesions [13].

**Aftercare**

The use of GnRH agonists and progestin therapy is recommended for the treatment of deep infiltrating endometriosis [13].

**References**

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are only indicated in rare cases. Therefore, the extent of resection, including possible perioperative complications, should be carefully discussed with the patient preoperatively. In some cases, endometriosis can only incompletely removed in order to preserve fertility. In several studies abdominal pain, quality of life and fertility is positively affected by surgical treatment in DIE [15].

Treatment of patients with DIE should only be performed in specialized centers with an active interdisciplinary cooperation (at least gynecology, surgery, urology). Urinary retention – due to extrinsic or intrinsic DIE of the ureter – requires immediate surgical intervention to prevent persisting damage to the kidneys [3]. Therefore, regular kidney sonography is indispensible in gynecologic evaluation of DIE patients.

**Adenomyosis Uteri**

**Medical Treatment**

Progestagens, combined contraceptives in longterm use and levonorgestrel-releasing IUDs are effective alternatives to hysterectomy [16]. The therapeutic value is based on the induction of amenorrhoea. Interventional-radiologic procedures such as embolization [17] and MRI-guided focussed ultrasound surgery are still experimental [18] and should be only indicated in rare cases. Therefore, the extent of resection, including possible perioperative complications, should be carefully discussed with the patient preoperatively. In some cases, endometriosis can only incompletely removed in order to preserve fertility. In several studies abdominal pain, quality of life and fertility is positively affected by surgical treatment in DIE [15].

In cases of incomplete endometriotic tissue removal to preserve fertility, surgical treatment should only be performed in specialized centers with an active interdisciplinary cooperation (at least gynecology, surgery, urology). Urinary retention – due to extrinsic or intrinsic DIE of the ureter – requires immediate surgical intervention to prevent persisting damage to the kidneys [3]. Therefore, regular kidney sonography is indispensible in gynecologic evaluation of DIE patients.

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currently be offered only to patients as part of clinical trials.

Surgical Treatment
After finishing family planning, the most helpful treatment of symptomatic patients is hysterectomy [3]. Patients, who wish to maintain the uterus, probably benefit from uterus-preserving surgical treatment with removal of focal adenomyosis. However, this method has not yet been proven in clinical trials.

Medical Treatment

GnRH Agonists / GnRH Antagonists
GnRH agonists suppress the pulsatile activity of the hypothalamus. After an initial gonadotropin "flare" up, LH (luteinizing hormone) and FSH (follicle stimulating hormone) are decreasing. Consecutively, estradiol levels drop down, the endometriosis lesions are diminished and amenorrhea with secondary insufficiency of the ovaries results [19]. Usually, GnRH agonists are used as a depot e.g. Goserelin and Leuprorelin. However, patients often suffer from typically postmenopausal symptoms such as hot flushes and sleep disorders. In addition, a reduction of bone density (Osteoporosis) can be observed. Because of these side effects, the use of GnRH agonists is only recommended for 6 months. An ad

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وسباق وموارد.

وتجارب وتوليد

وصفت

وخاصة

الكلية في تقييم أعراض النساء

العوامل الطبية

 sữaوس ودواء باستخدام طويل الأمد لمواد الحمل الفموية

المختلطة واللوالب المفرزة للهرمون
additional add-back therapy with a combination of estrogen/progestagen or only estrogen should be initiated to reduce symptoms and to protect the bone density without influencing the effectiveness in endometriosis treatment. A novel treatment option is an orally bioavailable GnRH antagonist (Elagolix) [20]. The advantage is the oral application with fewer side effects, especially with respect to bone density.

Progestagens
Progestagens suppress the hypothalamic-pituitary-gonadal axis and reduce the estrogen level consecutively. Furthermore, progestagens directly affect the endometrium by decidualization and atrophy of eutrop endometrium and endometriosis lesions. Additionally, progestagens suppress the matrix metalloproteinases, playing an important role in the growth of ectopic endometrium [21]. Progestagens also have an anti-inflammatory effect by inhibition of prostaglandin expression. As a result, menstrual bleeding and other respective complaints are reduced. Negative side effects are vaginal spotting, edemas, impure skin or psychological changes. Progestagens are commercially available as so called minipill (Desogestrel 0.075 mg) or 3-month-injection. Since 2010, 2mg Dienogest is accredited (Visanne®) especially for endometriosis treatment. Because of their local effect, Levonorgestrel-releasing IUDs are used particularly in patients with adenomyosis or deep infiltrating endometriosis.

Combined Oral Contraceptives
The effect of estrogen-progestagen combination is comparable with progestagen only. Because of the significant effect of Dienogest on the endometrium, a combination should contain Dienogest as progestagen component e.g. Valette® (0.03mg Ethinylestradiol, 2mg Dienogest). In order to treat endometriosis-associated pain two ways of application are possible: cyclic or continuous use, respectively. Two systematic reviews postulate a superiorly effect of continuous application regarding the improvement of endometriosis-associated pain [22, 23].

Aromatase Inhibitors
The use of aromatase inhibitors is currently an off-label use and is only indicated for patients with refractory endometriosis-associated pain. Aromatase inhibitors are regulating the estrogen production in endometriosis lesions additionally to the inhibition of the estrogen synthase Ki67 by feedback inhibition of estrogen receptor β.

The GnRH analogs are mostly used in menopausal or postmenopausal patients with hormone receptor-positive breast cancer. In postmenopausal patients, GnRH agonists cause a rapid decrease of circulating estrogen levels leading to bone loss. GnRH antagonists, on the other hand, cause a rapid increase of circulating estrogen levels without influencing the effect of hormone replacement therapy [24].

The role of GnRH in endometriosis is still under debate. GnRH analogs are mostly used in patients with refractory endometriosis-associated pain. Aromatase inhibitors are mostly used in patients with hormone receptor-positive breast cancer. GnRH antagonists are mostly used in postmenopausal patients with hormone receptor-positive breast cancer.
production in the ovaries, the muscle and fatty tissue [24]. A systematic review could demonstrate that aromatase inhibitors in combination with progestagens, continuous oral contraceptives or GnRH agonists are associated with significantly greater pain reduction compared to GnRH agonists alone [25]. Disadvantages in treatment with aromatase inhibitors are a loss of bone density and risk of developing ovarian cysts. The used substances are Anastrozol 1mg or Letrozol 2,5mg.

Selective Progesterone Receptor Modulator (SPRM) SPRM treatment leads to anovulation, amenorrhea and low levels of progesterone. These effects result in pain reduction along with a regression of endometriosis lesions [26]. Since 2012, Esmya® (5mg Ulipristalacetat) is used for preoperative treatment of patients with symptomatic uterus myomatous. Currently, the treatment of endometriosis patients with SPRMs is an off-label use.

Pain Management Analgesics used to treat endometriosis patients are Acetylsalicylic Acid, Ibuprofen, Diclofenac, Naproxen or Indometacine. So far, evidence confirms that Esmya® (5mg Ulipristalacetat) is superior to the use of oral contraceptives. Gupta et al. [26] showed that 87% of women treated with Esmya® reported a significant pain reduction compared to 51% on oral contraceptives. Therefore, Esmya® is strongly recommended as a treatment option for women suffering from endometriosis-related pain.

The use of Esmya® is contraindicated in patients with a history of thromboembolic disease, liver disease, or a history of breast cancer. The most common side effects reported in studies are nausea, vomiting, diarrhea, and abdominal pain. The incidence of these side effects is lower with Esmya® than with other options for pain relief. Esmya® is also more effective in reducing pain than placebo [26].

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Summary

So far, causal therapies for endometriosis do not exist. If symptomatic patients, primary aim is the complete removal of all endometriosis lesions, mostly by laparoscopy. If a patient with endometriosis is asymptomatic and has no desire to have children, treatment is not necessary.

Exceptions represent organ destruction e.g. ureterstenosis with consecutive hydronephrosis due to endometriosis lesions. An individualized therapy with good inter disciplinary team work is necessary for surgical treatment of deep infiltrating endometriosis.

for positive effects of treatment with antirheumatica and antiphlogistica [7] in endometriosis patients are missing. In addition to the pharmacological approach, therapeutic exercise, massage, yoga and mud baths are useful for treatment of dysmenorrhoea. Another therapeutic option is the Complementary Medicine such as Acupuncture, Traditional Chinese Medicine (TCM), Homeopathy, Phytotherapy and Physiotherapy. For most of these treatments randomized studies are missing. Further on, additional positive effects can be obtained by the integration of Psychosomatic Therapy [3].

GnRH agonist ESmya#2

Fig. 6: Intraoperative image of surgery of deep infiltrating endometriosis (#2)
infiltrating endometriosis (e.g. bowel, bladder and/or ureter).

The extent of surgery has to be evaluated regarding morbidity and relapse risk. As alternative to surgical treatment, different medical treatment options are useful. Progestagens, combined oral contraceptives and GnRH agonists are comparable in their efficacy.

Levonorgestrel-releasing IUD is an effective option especially in adenomyosis uteri and deep infiltrating endometriosis. Therapy with aromatase inhibitors and SPRMs are currently an off-label use.

SPRM

*مصريَّة* باستخدام عَجَالات مع المريضات المصابات بانتباذات بطانة الرحم.

*علاج الألم*


**Fig. 7: Intraoperative image of surgery of deep infiltrating endometriosis (#3)**


21

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**Introduction**

Prostate cancer is today the most common malignant tumor worldwide in men. Despite significant improvements in diagnostic imaging and therapy a persistently high number of patients are dying from this disease. The recent introduction of new innovative ways to target prostate cancer with radioactively labelled substances appears very promising. The Department of Nuclear Medicine at the Universitätsklinikum Essen, Germany, among other leading centers worldwide is now offering this innovative imaging and therapy. The rationale behind this newly introduced technique is a principle which can be compared to the lock and key analogy (Fig. 1).

Many prostate cancers express a receptor called prostate specific membrane antigen (PSMA), which serves in the used analogy as lock. Scientists recently discovered very specific ligands binding to the PSMA receptor [1, 2]. These specific ligands serve as the key of the employed lock and key analogy. The specific ligand can be labelled with a radionuclide, which - depending on the radionuclide chosen - can then be used for imaging or therapy. The spectrum of radionuclides currently used for labelling PSMA binding ligands comprise Gamma-, Beta- or Alpha-decaying radionuclides which can be used for imaging, therapy or both. Table 1 summarizes common radionuclides.

At Universitätsklinikum Essen we use for imaging mostly the positron emitting radionuclides $^{68}$Ga- and $^{18}$F-PSMA, which allow PET imaging of the PSMA ligands which - depending on the radionuclide chosen - can then be used for imaging or therapy. The spectrum of radionuclides currently used for imaging mostly the positron emitting radionuclides $^{68}$Ga- and $^{18}$F-PSMA, which allow PET imaging of the PSMA ligands which - depending on the radionuclide chosen - can then be used for imaging or therapy.
Radioactive Decay Typically Used in Nuclear Medicine

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<td>Lutetium-177</td>
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<tr>
<td>Beta-Plus</td>
<td>PET</td>
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<tr>
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Typ II, a protein bound to the outer surface of cells, is present at very high levels in prostate cancer. Levels of PSMA correlate with aggressiveness and Gleason Score [3, 4].

Several radiopharmaceuticals with high affinity to PSMA have been developed in the past [5, 6]. The Gallium-68 labeled ligand Ga-68 PSMA-HBED-CC is used in many centers in Germany and throughout the world for PET imaging (Fig. 2).

Afshar-Oromieh et al. demonstrated in a study on 37 patients superior tumor-to-background uptake and metastases detection of this ligand when compared to 18F-Cholin PET [7]. High accuracy for the localization of recurrent prostate cancer has led to inclusion of Ga-68 PSMA PET/CT in guidelines of the European Association of Urology in 2017 [8, 9]. Other studies prove superior accuracy for primary staging or restaging of prostate cancer [10]. Several Phase II/II clinical trials are underway to achieve approval of PSMA-directed PET/CT (clinicaltrials.gov: NCT02981368, NCT02940262).

For therapeutic purpose the PSMA specific ligand is labeled with high energy beta or alpha emitters. Once taken up by the tumor tissue, therapeutic tracers deliver radiation locally. Radiation induces DNA damage which eventually leads to cell death and tumor shrinkage. Radiotherapy is started by i.v. injection of radiopharmaceutical to eventually reach all tumor cells throughout the body (systemic treatment). Imaging and therapy tracers binding at the same target can be applied for diagnosis and therapy of cancer. This approach is termed “theranostic”. Gallium-68 PSMA ligands for PET imaging and Lutetium-177 PSMA ligands for radioligand therapy form such a theranostic pair for prostate cancer.

PSMA-Directed Positron Emission Tomography for Prostate Cancer Imaging

Prostate-specific membrane antigen (PSMA), also termed Glutamat Carboxypeptidase II (Typ II), a protein bound to the outer surface of cells, is present at very high levels in prostate cancer. Levels of PSMA correlate with aggressiveness and Gleason Score [3, 4].

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How is a PSMA PET/CT performed? PSMA PET/CT is an outpatient procedure involving the intravenous application of a radiopharmaceutical in a PET imaging unit followed by a one to two hour waiting time. Examination time is typically below 20 minutes. Patients can eat and drink normally before the procedure. Prostate cancer therapy can typically be continued.

Therapy of Metastatic PSMA-PET/CT is an ideal target for therapy. Accumulation of PSMA-labeled ligands is high in prostate cancer and low in surrounding organs, supporting safety in prostate cancer therapy can typically be continued. How is a PSMA PET/CT performed? PSMA PET/CT is an outpatient procedure involving the intravenous application of a radiopharmaceutical in a PET imaging unit followed by a one to two hour waiting time. Examination time is typically below 20 minutes. Patients can eat and drink normally before the procedure. Prostate cancer therapy can typically be continued.

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177Lu-PSMA617 therapy is not approved, however many centers offer this therapy under compassionate use protocols. PSMA PET/CT is used to diagnose tumor burden before start of therapy and after each two cycles (Fig. 3).

How is a PSMA radioligand therapy performed? Patients undergo first a PSMA PET/CT scan on outpatient basis to confirm the PSMA expression of a metastatic prostate cancer. If the kidney function is adequate the patient is admitted to the ward for two nights. During the hospital stay the intravenous application of the radiopharmaceutical is performed on day 1 and post-therapy images are acquired prior to discharge on day 3. Patients can eat and drink normally before the procedure, as well as during the hospitalization. Any potentially bone marrow-suppressing therapy has to be discontinued at least four weeks before the start of 177Lu-PSMA617 therapy. Other prostate cancer therapy can typically be continued. Side effects include decreased levels of red blood cells or platelets (less than 15% of patients) and mild nausea.

Summary
PSMA-directed positron emission tomography and radioligand therapy are emerging options for imaging and therapy of prostate cancer. Ongoing trials demonstrate high accuracy of PSMA PET/CT and efficacy of PSMA radioligand therapy and aim at regulatory approval. Many centers worldwide offer PSMA-directed positron emission tomography and radioligand therapy under local regulation or compassionate use protocols.

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Fig. 3: $^{68}$Ga-PSMA PET before (left) and after (right panel) $^{177}$Lu-PSMA617 therapy. After two cycles of therapy, PSA and tumor burden decreased considerably. $^{177}$Lu-PSMA617 therapy was continued.

Baseline $^{68}$Ga-PSMA PET

Follow-up after two Cycles of $^{177}$Lu-PSMA617 Therapy

Baseline PSA 425 ng/ml

Follow-up PSA 17 ng/ml


Cystic Tumors of the Pancreas

Introduction
The diagnosis of cystic lesions of the pancreas increased continuously over the past decades due to advances in imaging modalities [1]. The probability of detection of a cystic lesion of the pancreas by chance in an asymptomatic patient receiving abdominal MRI lies around 13.5% [2]. After diagnosis of a cystic lesion there is always the question on how to proceed after diagnosis of such cystic pancreatic lesion. Here multiple guidelines of different expert groups are available to support clinicians in their decisions [4-8]. Furthermore, we will focus of the effect of centralism in the field of pancreatic surgery, if resection of the cystic lesions has to be undertaken.

Diagnostic Methods
Imaging
After diagnosis of a cystic pancreatic lesion it has to be further classified. To differentiate pancreatic cystic lesions, MRI is the preferred imaging method [8]. Also, for follow-up surveillance MRI should be performed, to minimize radiation exposure. CT can be used in patients with suspected chronic pancreatitis to identify calcifications and for detection of associated pseudocysts. Additionally, CT should be performed in cases in whom pancreatic cancer is suspected.

Endosonography (EUS)
EUS is helpful as an additional diagnostic tool together with MRI and CT. Contrast enhanced EUS can detect hypervascularized mural nodules, septations or solid masses.

Endoscopic Retrograde Cholangiopancreatography (ERCP)
ERCP is helpful as an additional diagnostic tool to differentiate IPMN from solid lesions. However, ERCP is invasive and associated with a risk of complications.

Diagnostic Centers
We will focus of the effect of centralism in the field of pancreatic surgery, if resection of the cystic lesions has to be undertaken. Therefore, the decision about the treatment of the patient depends on the probability of detection of a cystic lesion of the pancreas by chance in an asymptomatic patient receiving abdominal MRI lies around 13.5% [2]. After diagnosis of a cystic lesion there is always the question on how to proceed after diagnosis of such cystic pancreatic lesion. Here multiple guidelines of different expert groups are available to support clinicians in their decisions [4-8]. Furthermore, we will focus of the effect of centralism in the field of pancreatic surgery, if resection of the cystic lesions has to be undertaken.

Key points
- Multiple guidelines are available to support clinicians in their decisions.
- Centralism in pancreatic surgery is important.
- Imaging modalities include MRI, CT, and EUS.

References
[3] Key role in the decision-making process.

Pancreatic Surgery
THE JOURNAL OF MEDICINE FOR THE WORLDWIDE MED COMMUNITY

 Tears of the Pancreas

الورم الكيسي

قد ركز تشخيص آفات البنكرياس الكيسي بتغيرات خلال العقود الماضية، وذلك نتيجة للتطور الحاصل في وسائل التصوير [1]. إن احتمالية تشخيص آفة كيسية بالبنكرياس بالصدفة في مرض عديم الأعراض يُجريه تصوير على البطن بالرنين المغناطيسي تقع في حدود 13.5% [2]. بعد تشخيص آفة كيسية يوجد دائمًا تساؤلات عن كيفية التواصل وإعطاء المريض القصة إلى جانب تشخيص وجود آفة بنكرياسية. إذا كان اتخاذ قرار ما بين المراقبة التحفظية والعلاج الجراحي يجب أن يتم بعناية - وراضين دائمًا في الاعتبار احتمالية خيال الآفة والمراضة المشتركة ومخاطر الفترة المحيطة بالجراحة المصاصة للمرضى. من بين التصنيفات المتعددة لآفات البنكرياس، فإن الأورام الحليمية الدوائية (IPMN، والأورام الكيسية المصلية) والورم الكيسي (MCN) والأورام الكيسية الكاذبة (SPN) تلعب دورًا مفتاحيًا [3]. تستند فيما يلي كيفية التواصل بعد تشخيص مثل
Pancreatic Tumors
Different Entities of Cystic Pancreatic Tumors

IPMN (Fig. 1, 2)
Intraductal papillary mucinous neoplasms originate from the main pancreatic duct or its branches. Men are more commonly affected by IPMN at a mean age of 60 - 70 years (30 - 94 years). IPMN are most frequently located in the main duct and its branches. On the other hand, FNA should only be performed when a clear change in management is expected from its result.

Biomarkers
Different biomarkers play a minor role in differentiating pancreatic cystic lesions during routine diagnostic workup. If malignant transformation of IPMN is suspected, serum cancer antigen 19.9 (CA 19.9) can be evaluated [10]. Furthermore, mutations in GNAS and KRAS in the cystic fluid aspirate can help identifying mucin producing cystic lesions [11].

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tion for resection should be followed life-long [13]. Patients with mixed type IPMN should be managed as patients with MD-IPMN, as risk for malignancy is comparable [14]. In patients with BD-IPMN mural nodules with contrast enhancement \(\geq 5\) mm, solid mass, high grade dysplasia or cancer in cytology as well as jaundice constitute absolute indications for surgery. Elevated CA 19.9 \(> 37\) U/ml, diameter of the cystic lesion of \(\geq 40\) mm, mural nodules \(> 5\) mm, growth rate \(\geq 5\) mm / year and new onset symptoms (diabetes, pancrea-

MD-IPMN خباثة. يُمثل ورم المُصاحبة بقناة بنكرياسية ≤ 5 مم داعيًا مطلقًا للاستئصال: حيث احتمالية الخباثة مرتفعة. في حالة المُصاحبة بقناة بنكرياسية معدلها 6 أشهر يُجرى فيها تصوير بالرنين المغناطيسي، بينما الشبب الصالح لإجراء جراحة قد يستفيدون من استئصال مبكر [12]. المرضى

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Fig. 1: T2-weighted MRI scans of MD-IPMN (A) and MT-IPMN (B); MRCP of MD-IPMN (C) and MT-IPMN (D)
The mucinous cystic neoplasms (MCNs) of the pancreas (Fig. 3C) are usually multilocular with a low-grade dysplasia, with a peak mean age of 49 years and a predominant localization in the pancreatic corpus or tail. They are mainly localized in women (70%) at an average age of 66 years (34–91 years). It is mainly localized in the pancreatic corpus or tail.

While one third is detected by chance in abdominal imaging, two thirds of the patients present with unspecific abdominal symptoms like pain, nausea, and weight loss. Jaundice is not common. In imaging it presents as a multilocular hypervascularized cyst with sharp margins. The MCN is a cystic neoplasm that produces mucin and is found predominantly in females at a mean age of 49 years.
circumscription and a central scar. The serous oligocystic adenoma is formed from few large cysts. Their incidence is smaller than that of serous microcystic adenomas with a peak mean age of 65 years (30–69 years) and no difference in gender. Serous oligocystic adenomas are found predominantly in the head and the corpus of the pancreas. As in serous microcystic adenomas symptoms are unspecific, but steatorrhea or jaundice can occur due to localization in the pancreatic head.

In cases of a clear diagnosis of an SCN asymptomatic patients should be followed for 1 year. After that, follow up is only recommended if symptoms occur. SCN should be resected if there is compromise of surrounding organs.

SPN (Fig. 3B)
Solid pseudopapillary neoplasm are in most cases benign, affect young females at a mean peak mean age of 30–69 years and no difference in gender. Serous oligocystic adenomas are found predominantly in the head and the corpus of the pancreas. As in serous microcystic adenomas symptoms are unspecific, but steatorrhea or jaundice can occur due to localization in the pancreatic head.

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SPN (Fig. 3B)
Solid pseudopapillary neoplasm are in most cases benign, affect young females at a mean

Fig. 2: T2-weighted MRI scan of BD-IPMN (A); MRCP of BD-IPMN (B)
Pancreatic surgery should be performed at high-volume centers

Albeit constant advances in perioperative treatment, pancreatic surgery is still accompanied by high rates of morbidity and mortality. A study from 2016 comprising 58003 pancreatic resections between 2009 and 2013 revealed a nationwide mortality of 10.1% in Germany [19]. Furthermore, there is a clear association between hospital-volume and outcomes [18].

The age of 35 years (8 – 67 years) and occur in the whole pancreas. Symptoms are unspecific and most diagnosis is made by chance. Imaging shows a cystic and solid mass, with contrast medium enhancement of the solid sub-segments. Resection of SPN is recommended [17].

Even in cases of metastatic or recurrent disease a radical resection is recommended, due to its good long-term outcomes [18].

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المجلة الطبية العالمية للمجتمع المعرفي
rates of mortality [20]. This volume-mortality relationship was further investigated by Krautz et al. They performed a database analysis of 60858 pancreatic resections between 2009 and 2014 in Germany. Resections included pancreaticoduodenectomies, total pancreatectomies, distal resections and segmental resections.

Hospital volume was separated in quintiles and surgery related in-hospital death analyzed as the primary outcome according to those quintiles. As a secondary outcome, failure to rescue was investigated. In the very low volume group (398 ± 8.5 hospitals) 5.1 ± 3.7 pancreatic resections were performed. In the highest volume group (15 ± 0.8 hospitals) there were 133.8 ± 95.7 pancreatic resections performed per year. In-hospital mortality was inversely correlated with volume, as there were 6.1% deaths in the highest volume group in comparison with 13.0% in the lowest volume group resulting in an odds ratio of 0.47 (95% CI 0.41 – 0.54) in favor of high-volume centers. By theoretical increase in hospital-volume of 50 pancreatic resections per year, there would be a significant risk reduction achievable (OR: 0.90; 95% CI 0.85-0.96). Furthermore, failure to rescue was significantly lower in high-volume centers. When looking at resection for pancreatic cancer, operation at a high-volume center is associated with an improved 30-day survival (mortality: 2.0% vs. 6.3% (p<0.01)) as well as long term survival (20.3 months vs. 15.7 months). Additionally, radicalness of resections is significantly better at high-volume centers concerning lymph node dissection (16 vs. 11; p<0.01) as well as R1 resection (20.5% vs. 25.9%; p=0.01) [21].

Thus, these data clearly show, that pancreatic surgery should be performed at high-volume centers. In these institutions surgeons are specifically trained for complex operations and have a high operative experience, which has been shown to be of specific relevance to improve outcome after surgery [22].

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Keywords: osteochondroma of the rib, mediastinal tumour, florid mediastinitis

Introduction

Osteochondromas are common bone tumours accounting for 35% of all benign bone tumours; however, only in rare cases (2.4%) do they affect the ribs. They are often asymptomatic and diagnosed incidentally. Patients may present with symptoms such as fracture, deformation, malignant transformation and compression of adjacent neurovascular structures, the spinal cord and other organs.

The case report presented below is about a 30-year-old man with an osteochondroma mimicking multiple exostoses. Chest X-ray and computed tomography (CT) imaging revealed a fusion between the right 7th rib and the tumour. The histological examinations and the radiological findings confirmed the lesion to be an osteochondroma.

Given the risk of complications such as infections or malignant transformation, such tumours require complete resection. Complete resection is necessary because recurrence is common after incomplete resection. In addition, a surgical procedure is the only way to determine the dignity of such tumours beyond doubt.

In this case report, we inform about this rare condition from our clinical experience.

Case Report

In clinical routine, a 30-year-old patient presented with a monstrous mass in the posterior mediastinum, the size of which is shown in the CT scan. He presented to the general practitioner on an outpatient basis with difficulty swallowing.

The patient was admitted to our Department of Cardiothoracic Surgery for further diagnosis due to the mediastinal mass. The X-ray image in AP projection and in lateral view revealed a mass in the posterior mediastinum of approx. 15 x 12 cm in size (Fig. 1 and 2). The non-contrast chest CT revealed a large, cystic, partly calcified retrocardiac mass in the posterior mediastinum, displacing the heart (Fig. 3 and 4). Biopsy of the mass was performed, suggesting a large bronchogenic cyst. The surgery confirmed the lesion to be an osteochondroma.

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was scheduled. The biopsy was performed to rule out a sarcoma or other malignant neoplasm in the thorax. On 16/05/2016, the patient again presented to our Central Accident and Emergency Department with retrosternal pain and clinical signs of sepsis. Given the significantly elevated inflammatory parameters and elevated TNI, as evidenced by the laboratory findings, the patient was admitted to the IMC for further diagnosis and treatment. Empiric antibiotic therapy with piperacillin and tazobactam was initiated. Another chest CT was performed, revealing an infection...
Primary en bloc resection of the tumour was not possible due to significant fusion with the ribs and vertebral bodies. The postoperative chest CT showed the known cystic retrocardiac space-occupying process in the dorsal mediastinum, with its AP diameter decreasing from approx. 7.8 cm to approx. 4.2 cm. Intralvesional air pockets were clearly regressive. The planned tumor reduction and the pleural

Fig. 2

of the mediastinal cyst/DD: mass after oesophageal biopsy (Fig. 5 and 6). The surgical removal was started on the left side to reduce the tumour mass and control the local infection. Smears were taken and parts of the apical cyst wall were removed by means of left-sided basal thoracotomy; a disinfecting tamponade was inserted into the cyst twice the size of a fist and relocated to the right. A further sampling was performed on the right side, however, as the cystic mass was not reducible and the fusion with the ribs and vertebral bodies was significant. The biopsy showed a malignant epithelial tumor with a cystic component. The tumour reduction was performed on the left side starting with a biopsy of the tumour and the planned reduction and the pleural

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Fig. 1 (P): Lamellar structure, consisting predominantly of slightly lobulated hyaline cartilage tissue

الشكل 1 (P): بنية صفائحية، تتكون بالأساس من نسيج غضروف هيالوني مفصص بشكل طفيف

Fig. 2 (P): Atypia-free chondrocytes

الشكل 2 (P): خلايا غضروفية خالية من الالوانية
debridement were then carried out from the right. The scheduled revision from the right side was performed a few days later. The histological examinations revealed membranous formations of osteochondral tissue with a characteristic lamellar structure, exhibiting a thin lamella of connective tissue on the surface, an intermediate broader lamella of hyaline cartilage tissue and an internal lamella of bone. The histomorphological examination did not show any significant nuclear atypia or mitotic activity of the cartilaginous tissue, with cellularity being slightly increased. Infiltrative or destructive growth or cytological signs of malignancy were not observed. The detection of significant focal granulocytic infiltration into the superficial fibrotic tissue portions, as a microscopic correlate of the clinically diagnosed mediastinal infection, was noteworthy.

The persistent infection with local mediastinitis necessitated another excision and destruction of diseased mediastinal tissue on the left side. As a supportive measure, a suction-irrigation drain was placed inside the residual cavity. Unfortunately, complete tumour resection was not possible, because the dorsal portions were fused with the vertebral column on the right. Due to the incomplete resection, we planned close follow-up examinations by means of non-contract chest CT. The patient was informed about the causes and reasons and was closely involved in the concept.

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The irrigation enabled us to control the infection, the antibiotic therapy was stopped and the drain in place was gradually removed. The wounds healed by first intention; the patient was transferred to a rehabilitation facility.

Discussion
A monstrous tumour of unknown causation in the posterior inferior mediastinum prompted us to present this case report. Later on, we diagnosed a thoracic osteochondroma arising from the right...

...lsowehol, فان الاستئصال الكامل للورم لم يكن ممكنًا: فالأجزاء الخلفية كانت ملتحمة مع العمود الفقري على الناحية اليمنى. بسبب الاستئصال غير الكامل، خططنا متابعة المريض عن كثب بإجراء فحوصات للصدر في صورة تصوير...
The diagnostic procedure is aimed at determining the tumour dignity prior to the surgery to rule out the presence of a malignant tumour. The oncological principles would then have to be implemented accordingly.

There were no doubts about open surgery being indicated. Treatment of the monstrous tumour was only possibly using a conventional open thoracic surgical procedure (thoracotomy); minimally invasive surgical methods (e.g. VATS or RATS) were not considered due to the specific position of the tumour.

7th rib with superinfection, as a differential diagnosis of a tumour in the posterior inferior mediastinum. This means that the tumour was identified as an osteochondroma with an infection of its content and this tumour constituted a differential diagnosis of a tumour in the posterior inferior mediastinum. In the literature, only case reports are available for these tumour entities. Based on this example, our case report presents the bizarre tumour with complete displacement of the mediastinum.

The CT scan following the operation shows a postoperative haemorrhage, with overall regression of fluid in the resected area; no progressive retention with the drains in place.

The first paragraph mentions the misdiagnosis of a malignant tumour due to an infection of its content. The tumour was identified as an osteochondroma with an infection of its content, and it was ruled out that the tumour was malignant.

The second paragraph describes the surgical procedure, which involved open thoracic surgery due to the specific position of the tumour.

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were not an option, given the size of the lesion displacing the mediastinal structures; the condition was complicated by the postoperative infection of the multilocular tumour, which ultimately led to the mediastinal infection as a result of the surgical procedure and the opening of the tumour capsule.

Complete resection of the osteochondroma was not possible at any point of the surgical procedures, which is why the posterior portions were left in place. It was not possible to control the infection by means of antibiotic therapy; cleaning of the posterior inferior, now restructured mediastinum was ultimately achieved by using the suction-irrigation drain.

In the course of thoracic surgical management, the pulmonary ligament was bilaterally dissected and the basal lung area was mobilised and decor- ticated several times to treat a persistent toxic empyema.

The prolonged treatment has so far proved successful.

Summary
We present a case of an osteochondroma with a bizarre clinical appearance arising in the right posterior arch of the 7th rib, which ultimately mimicked a mediastinal tumour. A structured five-stage procedure was required to at least partially remove the tumour. The postoperative course was uneventful and the patient was discharged to a rehabilitation facility. Follow-up care is essential, because the osteochondroma was not resected completely.

Literature
Orthodontic Splint Treatment of Patients with Limited Bone Supply

Summary

Misalignment of jaw bones with one another other can often only be treated for adult patients via purely orthodontic measures. With such patients, a combined orthodontic/surgical orthodontic treatment is usually indicated. In addition to the standardised methods of treatment, the following therapies will be individually planned and carried out. Orthodontic tooth movement depends on the bone. With pronounced lack of space, gaps in the bone, large bony cavities, etc., in the case of cleft patients, the bone supply is insufficient to perform a successful orthodontic therapy.

For this reason, alternatives were sought to improve the bone supply. Increasingly, applications of regenerative medicine, which are already known in tumor therapy, are used for bone formation prior to orthodontic therapy. By way of example, it is shown that the introduction of an individually adapted 3D bone block not only improves aesthetics, but also allows tooth movement with splints without complications.

Fig. 1: Histological specimen demonstrates bone supply by one tooth.

Problems
With the use of plastic splints for orthodontic therapy, many types of tooth misalignments can be corrected. With removable devices, it is now possible to achieve functional and aesthetically very good therapeutic results (1). If, for example, alignment-technology splints were recommended in orthodontic splint treatment of patients with limited bone supply, the apparatus would only improve aesthetics, but also allows tooth movement with splints without complications.

ملخص البحث

 عدم ارتداد عموم التكبير مع بعضهما يمكن علاجه عند الكبار عادة عن طريق إجراءات المعالجة السنية التقويمية فقط. عادة يطلب ملء هؤلاء المرضى علاج تقويمي/جراحي بالإضافة إلى وسائل العلاج المجبرية، سيتم تخطيط وتنفيذ العلاجات الأثية بشكل فردي. يعتمد تحريك الأسنان التقويمية على العظم. مع وجود نقص شديد في حجم الحيز المتاح وجود فجوات بالعظم وتجاويف عظمية كبيرة إلخ، في حالة مرضى الحنك المشقوق، فإنه يوجد قصور في الإمداد الدموي لإجراء علاج سني تقويمي. لهذا السبب، تم البحث عن بديل لتحسین الإمداد الدموي تطبيقات الطب التجديدي والمعروفة بالفعل في علاج الأورام. يتم استخدامها بشكل متزايد لتكوين العظام قبل العلاج السني التقويمي على سبيل المثال، لقد اتضح أن إدخال إسقاط عظمي ثلاثي الأبعاد 3D والذي تم تكييفه بحسب كل فرد لا يحسن التركيبات التجميلية فقط بل يسمح أيضاً بحركة الأسنان بالجبيهة بدون مضاعفات.
the past only for mild to moderate malocclusions, the current state of knowledge shows that even more complex treatments are possible with this system. Orthodontic tooth movement, however, is determined by the periodontal structure and bone supply. These factors are incorporated in the treatment planning.

The bones in the body constantly undergo re-modelling processes (2, 3). There, where the skeleton is subjected to increased stress, more bone substance is built up, and where the stress is low, the bone is broken down. The bone cells (osteoblasts and osteoclasts) are responsible for this process, which normally work in balance with each other. If this balance is disturbed, it can lead to a greater loss of bone mass (Fig. 1). When it comes to the jaw, there are many causes of pathological bone loss. In addition to age-related causes, there are causes that genetically determine the shape of bones. The bone shape and position is related to the occlusion. Altered bone growth leads to the discrepancy of upper and lower jaw size.

The lower jaw, in particular, is subject to changes depending on the growth and position of the upper jaw (Fig. 2). The stress on the alveolar bone during mastication is an essential functional stimulus underlying the maintenance of a healthy bone and periodontium. Lack of mechanical stress, including tooth loss, is the main cause of non-inflammatory resorption. Additionally, it is proposed that the loss of bone mass is a result of the imbalance in the regenerative capacity of bone cells (osteoblasts and osteoclasts). The balance of these cells is maintained by local and systemic factors, and deviations from this balance can lead to bone loss.

In conclusion, the treatment of malocclusions involves understanding the complex interplay between bone growth and function. By recognizing and addressing the underlying causes, orthodontists can develop effective treatment plans that promote healthy bone growth and function, leading to improved oral health and overall well-being.
Regenerative Medicine

There is no doubt that regenerative medicine is becoming increasingly important in dentistry and in orthodontics in particular; on the one hand, with the growing number of elderly patients who have already had or currently have degenerative processes, and on the other hand, with patients whose hereditary unfavourable hard and/or soft tissue conditions that make orthodontic treatment difficult or even impossible. Especially when it comes to patients with horizontal and vertical bone loss or patients with complete dentoalveolar collapse, tooth movements are much more difficult to perform. In recent years, tremendous progress has been made in the regeneration of hard and soft tissues in the orofacial region. Regenerative medicine includes the repair and restoration, as well as the biological replacement, of the defective or non-functioning tissues, which have been lost due to the loss of teeth leads to atrophy of the alveolar bone (4, 5). This process is most commonly observed after the extraction of teeth. When planning tooth movements, teeth can only be moved by the orthodontist if there is enough jawbone, since, after therapy has been completed, too thin of a jawbone will not provide sufficient support for a tooth. In the case of strongly protruded teeth with a low supply of bone, various problems associated with the migration of the teeth from the bone substance can occur during bone build-up. Untreated periodontitis can also lead to bone loss, which can ultimately lead to undesired tooth movement or loss. The actual alveolar bone loss often begins unnoticed.

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Fig. 4: The virtual planning of the treatment in the computer. 3D visualisation in the ClinCheck program (Invisalign) of the state and planned end result. Achieve neutral dentition on both sides and upright positioning of the incisors.

الشكل 4: التخطيط الافتراضي للعلاج باستخدام الحاسوب. العرض البصري ثلاثي الأبعاد (كلنتشيك) في برنامج (إنيفينالين) للوضع الحالي والنتيجة المتوقعة التي تم التخطيط لها. تحقق التصنيع المحايد على الجانبين والوضع الرأس للفواط.
recessive changes, diseases or congenital defects, or were damaged (6). To stimulate the body's own regeneration and repair processes, methods for tissue or cell stimulation, for example, using growth factors or the integration of biologically or synthetically produced replacement materials, are currently being used. These procedures are also used in dentistry (7). The aim of using substitute materials is to achieve biological integration and, at the same time, the body's own regeneration of dysfunctional tissue.

The act of filling spaces with bone substitute material (augmentation) is a part of reconstructive surgery and has been central to implantology for years (8). The augmentation process is either done with artificial substitute material, or with human autologous or donor bone; the patient's own processed teeth may also be considered for these purposes.

Bone Planning
Orthodontic cases with extensive lesions of the alveolar bone constitute a serious therapeutic challenge. Prophylactic bone augmentation prior to orthodontic therapy must be planned via the existing bone. The teeth must be able to move easily after inserting the bone substitute into the new “bone compartment.” The concept of splint treatment and regenerative bone augmentation is based on very accurate diagnostics. In addition to the basic orthodontic evaluation, a DVT-Scan must be made for each patient (Fig. 3). This diagnostic is used by the orthodontist and the surgeon to plan bone requirements, as well as a template for surgical planning. Based on the DVT examination, a virtual model of the anterior lower jaw area is made. Based on this model, a design for a bone graft is created. The bone graft is adapted to the existing bone. Incorrect-

Fig. 5: FRS with and without a bone substitute. A change in the lip position is visible.
Fig. 6: Intra-oral situation at the start of treatment. Narrow cover bite with reserve of lower jaw.

الشكل 6: الوضع داخل الفم عند بدء العلاج. عضة غطائية ضيقة مع الحفاظ على الفك السفلي.
ly adjusted bone replacement can lead to inflammation and irritation of the soft tissue. The individual production of the 3D bone replacement takes place in the CAD-CAM procedure.

Planning Orthodontic Therapy

The actual planning of the tooth movement is carried out with the help of the electronic setup using a computer program, which can be visualised as a ClinCheck (Fig. 4). During the treatment planning phase, the individual steps can be discussed with the patient, as well as with the surgeon. In the framework of interdisciplinary therapy planning, it is possible to specify a precise time schedule for all participants. In this case, a bone substitute can also be planned and inserted during an aligner therapy.

In the computer program, a tooth movement from the bone structure is not possible. You will be warned by the program prior to a dental exercise. However, by request of the program administrator, it is possible to extend the tooth movement, and therefore, to plan the therapy. Surgical recall can also be done in parallel with the orthodontic treatment. In addition to the tooth position and placement of the bone replacement, the effect of the surgical procedure on the patient’s facial profile is also discussed. The facial profile prior to therapy is often not optimal - even from an aesthetic point of view. The position of the chin is dependent on the positions of the teeth and the jaw to one another. Accordingly, the chin is too dominant in the front. A surgical pro-

Fig. 7: DVT is a condition. Due to strong protrusion of the teeth there is no bone at the labial area.
Bone fragment is inserted and the surgery is terminated.

For the implementation of the procedure, a local anesthesia is enough.

In the papillae areas, a full flap preparation is completed, followed by an attachment of bone fragments.

Fastening with pin in the lower jaw bone.

Replenish the area with bone replacement.

Suture close at end of surgery.

Fig. 8: Post-operatively, the stabilisation of the wound area must be ensured (gum bandage, no mechanical cleaning until the suture is removed).
The procedure influences the overall facial aesthetics and profile. This is due to the treatment of the harmonisation of the facial profile (Fig. 5).

**Treatment**

Selection of the appropriate patients for this therapy must be done very carefully. A 25-year-old patient with Class-II dentition in the University Clinic. Following extensive orthodontic diagnostics, the following diagnoses could be made: in the upper-jaw, a retraction of the central incisors with protrusion of the lateral incisors. The lack of space in the upper jaw amounted to a decrease of -4.8 mm. Tooth 26 was missing with complete gap closure. In the lower jaw, there was a lack of space of about 3 mm - associated with retraction of the incisors. The bite position was neutral on the right side in the 1st molar area, distal on the left, with a deep bite (Fig. 6).

The OPG showed a conservatively treated dentition. To better determine the bone supply, a DVT recording was performed. From this, strong

Fig. 9: Intra-oral situation after insertion of bone graft and removal of suture material. Undisturbed wound healing process. Aligner splint treatment has started.
alveolar bone atrophy could be determined (Fig. 7). The orthodontic treatment was discussed after a detailed medical history, in consultation with the patient. The treatment of choice was that of Invisalign splints and bone augmentation. To implement the treatment, attachments were also planned and glued on the teeth for anchoring. During the treatment, the setting of a Class-I dentition was done on both sides. In addition, the dental arches in the upper and lower jaw were formed harmoniously by protrusion of the incisors during the course of therapy. In the upper and lower jaw, the crowded space could be resolved by means of ASR. A pronounced Spee Curve was leveled out by means of ASR. A pronounced Spee Curve was leveled out by means of ASR.

During the surgical process, the 3D allograft is inserted, properly positioned and stabilized using resorbable pins. These measures contribute to the fact that the bone and soft tissue build-up after the tooth movement remains the same. Due to the fully individualized bone, the technical problem of space inaccuracy is eliminated and a tooth movement can be better planned. If the bone augmentation material is incorrectly selected, the tooth movement in such a built-up region poses a problem. Bone attachment to the desired position also uses the latest technology. At the end of surgery, the use of an artificial membrane and suturing of the gums is necessary. The tooth movement takes place immediately after the bone has been built-up, or after a short healing period (Fig. 8).

This surgical procedure protects the local jaw bone, and valuable bone areas are not lost. The minimally invasive procedure with bone preservation is used for very narrow alveolar ridges (Fig. 9).

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Advantages of the Additional Use of Autologous Bone Substitute Materials at Major Sinus Lift Operations

Keywords: Sinus lift operation, direct sinus lift, perforation, prognosis, graft material

Abstract

Background and Aims

This study focuses on augmentation materials for maxillary sinus augmentations and investigates the advantages of autologous iliac crest spongiosa in combination with xenogenous BioOss (manufacturer: Geistlich) in comparison to a use of pure xenogenous material.

 Patients and Methods

A total of 148 patients with 241 augmented sinuses and 666 inserted implants were analyzed retrospectively. All sinus membranes were covered with a BioMend® Extend (manufacturer: Zimmer) membrane and augmented with autologous iliac crest spongiosa combined with xenogenous BioOss® (manufacturer: Geistlich) or only with BioOss®. Postoperative complications and implant survival were analyzed. The influences of smoking and perforation of the Schneiderian membrane have also been investigated.

Results

At unperforated sinuses, the use of autologous bone improved the results from 95.0% (p<0.001) for pure BioOss® to 95.8% (p<0.001) success rate for BioOss® in combination with autologous bone and from 7.4% (p<0.001) implant loss rate to 3.8% (p<0.001). Perforated sinuses augmented with BioOss® and autologous bone reached 89.4% (p<0.001) success rate and 5.4% (p<0.001) implant loss rate, while pure BioOss® reached 91.7% (p<0.001) success rate and 8.7% (p<0.001) implant loss rate.

Conclusions

The use of autologous bone graft material improved the success rates of the sinus lifts and survival of the inserted implants compared to the use of pure xenogenous BioOss®.
Introduction

In the modern dental and maxillofacial surgery a multitude of different bone substitute materials exists [1, 2]. Apart from modern synthetic materials, autologous and xenogenous materials are still the most common bone substitute materials. Nowadays combinations of autologous and allogenic or xenogenous substitute materials are still the most common materials, and displace the synthetic materials increasingly [3]. Autologous and xenogenous materials have been tested for many years and have reliable prognoses. While dentists can only take autologous material from intraoral donor sites, maxillofacial surgeons are able to harvest bone from the iliac crest for greater augmentations using autologous bone substitutes.

One important advantage of autologous bone substitute materials is the possibility to take cortical and/or cancellous bone in dependence on the respective application area. If needed, cortical bone can be crushed for augmentation (picture 1) and so offers many possibilities. Furthermore, autologous bone includes bone cells with the ability to osteogenesis and osteoinduction beneath the single osteoconductive effects that also exist for xenogenous materials. In addition to all the benefits of autologous transplants, such as the ability for osteogenesis and the avoidance of foreign body reactions, additional complica-
tions risks and increased efforts are caused by the additional surgical intervention. This also leads to a large discomfort, since the additional engage-

Fig. 1: Intraoperative harvested bone is crushed for the augmentation of the maxillary sinus.

@BioOss صرف

ندور الصرف

النتائج

إن استخدام مادة لعظم ذاتي

المنشأ قد حسن نسب نجاح عمليات

الرفع الفكي وبناهي التشع

ومقارنة باستخدام

زي @BioOss مصورة

نسبة نجاح مقدارها 91.7 % بقيمة احتمالية مقدارها 0.001 (p)< 0.001 ونسبة فقد للعظام

مقدارها 8.7 % بقيمة احتمالية مقدارها 0.001 (p)< 0.001

يوجد في جراحات الأسنان والوجه

والكفين الحديثة عدًا كبيرًا من

المواد العظمية البديلة المختلفة

[1, 2]. وبدلاً عن المواد الصباعية

الحديثة، فإن المواد ذاتي

والاجنبية المنشأ لا تزال الأكثر

شیرة بين المواد العظمية البديلة.
accurate assessment is necessary to develop appropriate surgical concepts, in order to develop a concept that meets the needs of patients. In this context our study tries to evaluate how advantageous the additional use of autologous bone really is for augmentations of the maxillary sinus.

Patients and Methods
This investigation investigates a total of 148 consecutively operated patients, who underwent direct sinus lift operation. Of the 148 patients 78 were females (52.7%) and 70 males (47.3%). The youngest patient was - at the moment of the operation - 20 years old, the oldest was 86 years old.

The low effort and the limitless, inexpensive availability on the other hand are clear advantages of xenogenic bone substitute materials. Notwithstanding xenogenous materials merely act as a placeholder that allows an ingrowth of bone. Despite modern control mechanisms, disease transmissions are still conceivable, although they are not described in the current literature.

The use (Fig. 2) of autologous bone is mixed with xenogenous BioOss®. Against this background, the need for such additional procedure must be particularly considered and the patient should be informed about the possibilities and advantages of individual methods in detail.

Fig. 2: Autologous bone is mixed with xenogenous BioOss®.
Gated. The different resorption stages at the access window (manufacturer: Geistlich). The use of the previously used BioOss® and BioGide® (types: Active, Replace Select Straight, Replace Tapered, Replace Select Straight, Speedy), Straumann® (types: Standard Plus, SLActive) and Z-Systems® (type: Z-311) zirconia implants were used. This differentiation could be subject for further studies.

The collected data was split into sinus augmented with pure xenogenous material and those augmented with a combination of autologous and xenogenous material and processed in accordance to different risk factors. Three stages of differentiation exist. At first all data is splitted into the two groups of perforated and unperforated sinuses. On the second stage a differentiation is made between the two augmentation materials. The third stage divides both groups into smokers and non-smokers. This last stage did not fit the criteria for sufficient results because single groups get too small with less than 10 cases, as described in the discussion below. The influence of smoking on sinus lifts was also investigated in our previous study mentioned above.

All data was first processed in Microsoft® Excel® 2011 (Version 14.4.8) charts and the calculations of significances for the goal criteria were made with IBM® SPSS® Statistics software (Version 22). The significances between single times of both membranes are more important when used as coverage of the Schneiderian membrane. Also no differentiation was made between the different types of implants: Camlog®, Dentsply Sirona® (types: Ankylos®, XIVE®, ASTRA TECHTM), Nobel Biocare® (types: Active, Replace Straight, Replace Tapered, Replace Select Straight, Speedy), Straumann® (types: Standard Plus, SLActive) and Z-Systems® (type: Z-311) zirconia implants were used. This differentiation could be subject for further studies.

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groups were determined by using Student’s t-test and are shown in brackets for all results visible in chart 1 to 4.

Results

The results of our analysis are shown in tables 1 to 4 below. The first two tables show the patient distribution and total number of patients, the number of performed major sinus lift operations and inserted implants as well as gender distribution, average ages and implant insertion modes. The total data is shown in the grey field in the first line of the tables for both tables with unperforated (table 1) and perforated (table 2) Schneiderian membranes and is used as reference. As mentioned above, the differentiation between smokers and non-smokers did not achieve reliable results because on the last stage a minimum of 10 patients sinus lift operations was undercut. The excluded groups are shown in grey with deficient data marked in red. The direct comparison of the investigated bone graft materials showed a superiority of an additional use of autologous graft for perforated as well as for unperforated sinuses especially for the implant survival. At unperforated sinuses the use of pure xenogenous material led to a survival rate of 95.0% (p<0.001) and an implant loss rate of 7.4% (p<0.001) compared to a success rate of 95.8% (p<0.001) and implant loss rate of 3.8% (p<0.001) for a combination of autologous and xenogenous materials. Similar results were found for perforated sinuses with implant loss rates of 8.7% (p<0.001) for pure xenogenous and 5.4% (p<0.001) for autologous and xenogenous material in combination. Contrary results were found in the investigation of the success rates at perforated sinuses. Here pure xenogenous materials showed better results with 91.7% (p<0.001) in comparison with additional autologous material with 89.4% (p<0.001). Furthermore, the negative influence of smoking could be shown for some of the investigated groups while in some cases the small remaining differentiation groups of smokers and non-smokers failed to yield significant results. The lowest implant loss rate of 1.9% (p<0.001) was found for unperforated sinuses augmented with autologous and xenogenous material at nonsmokers. The success rate for the augmented sinuses was here also the highest compared to all other groups - exclusive all non-significant results or too small case numbers and amounted to 96.4% (p<0.001). Because many groups of the final stage failed to get significant results, a concrete investigation of the influence of smoking was not possible.

Discussion

Differences between Graft Materials

Our analysis scheme subdivides the groups of perforated and unperforated sinuses in those which were augmented with a combination of autologous bone from the iliac crest and xenogenous BioOss® and those which were augmented with pure BioOss®. While the success rates for the sinus augmentation are increased only minimal in the group.

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The results of our analysis are shown in tables 1 to 4 below. The direct comparison of the investigated bone graft materials showed a superiority of autologous and xenogenous bone material in combination. Contrary results were found in the investigation of the success rates at perforated sinuses. Here pure xenogenous materials showed better results with 91.7% (p<0.001) in comparison with additional autologous material with 89.4% (p<0.001). Furthermore, the negative influence of smoking could be shown for some of the investigated groups while in some cases the small remaining differentiation groups of smokers and non-smokers failed to yield significant results. The lowest implant loss rate of 1.9% (p<0.001) was found for unperforated sinuses augmented with autologous and xenogenous material at nonsmokers. The success rate for the augmented sinuses was here also the highest compared to all other groups - exclusive all non-significant results or too small case numbers - and amounted to 96.4% (p<0.001). Because many groups of the final stage failed to get significant results, a concrete investigation of the influence of smoking was not possible.

Discussion

Differences between Graft Materials

Our analysis scheme subdivides the groups of perforated and unperforated sinuses in those which were augmented with a combination of autologous bone from the iliac crest and xenogenous BioOss® and those which were augmented with pure BioOss®. While the success rates for the sinus augmentation are increased only minimal in the group.

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improve bone formation. This bone contains osteoblasts that for bone ingrowth. Autologous materials, it is not only a scaffold but also osteoinductive and is not only osteoconductive, of autologous bone is that it had been used. The advantage of the first graft materials that in dental surgery and is one years in orthopedic as well as authors. It is used for many advantages. The use of xenogenous materials is much easier, because it is of unlimited availability and does not need the additional surgical process of bone harvesting. Furthermore it is an ideal filling material that is not as fast resorbable as autologous bone. Nevertheless, bone harvesting for a dentist is only possible from intraoral sites and thus limited. Bone harvesting from the iliac crest, like in many patients in our study, is reserved for maxillofacial surgeons. Although many alternatives

<table>
<thead>
<tr>
<th>groups and subgroups</th>
<th>number of patients</th>
<th>average age (median)</th>
<th>performed sinus lifts</th>
<th>inserted implants</th>
</tr>
</thead>
<tbody>
<tr>
<td>total (reference)</td>
<td>148 patients</td>
<td>56.5 years (median 58.5)</td>
<td>241 sinuses 153 i.p.</td>
<td>88 d.i.p. 666</td>
</tr>
<tr>
<td>no perforation</td>
<td>128 patients</td>
<td>56.7 years (median 59)</td>
<td>182 sinuses 120 i.p.</td>
<td>66 d.i.p. 514</td>
</tr>
<tr>
<td>auto- and xenogenous material</td>
<td>93 patients 51 female (54.8%) 42 male (45.2%)</td>
<td>55.7 years (median 57.5)</td>
<td>142 sinuses 85 i.p.</td>
<td>57 d.i.p. 420</td>
</tr>
<tr>
<td>smokers</td>
<td>23 patients</td>
<td>47.3 years (median 52)</td>
<td>32 sinuses 22 i.p. 10 d.i.p.</td>
<td>103</td>
</tr>
<tr>
<td>non-smokers</td>
<td>70 patients 39 female (55.7%) 31 male (44.3%)</td>
<td>56.5 years (median 61)</td>
<td>110 sinuses 63 i.p. 47 d.i.p.</td>
<td>317</td>
</tr>
<tr>
<td>pure xenogenous material</td>
<td>35 patients 19 female (54.3%) 11 male (45.7%)</td>
<td>54.4 years (median 59)</td>
<td>40 sinuses 35 i.p. 5 d.i.p.</td>
<td>94</td>
</tr>
<tr>
<td>smokers</td>
<td>8 patients 3 female (37.5%) 5 male (62.5%)</td>
<td>40.5 years (median 57)</td>
<td>10 sinuses 7 i.p. 3 d.i.p.</td>
<td>23</td>
</tr>
<tr>
<td>non-smokers</td>
<td>27 patients 16 female (59.3%) 11 male (40.7%)</td>
<td>54.0 years (median 62.5)</td>
<td>30 sinuses 28 i.p. 2 d.i.p.</td>
<td>71</td>
</tr>
</tbody>
</table>

Table 1: This table shows the patient-related data for all sinus augmentations without perforation of the Schneiderian membrane. The total data is shown in the grey line on the upper section of the table. The two lower lines are also marked in grey because of the smokers group marked in red that yield a group of less than 10 patients.

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exist, autologous bone is still a safe and reliable augmentation material for sinus augmentation, like Wilkert-Walter et al. described in 2002 [18]. In contrast to this study, Nkenke and Steizie reviewed 21 articles about graft materials in 2009 and described autologous bone not to have improving influences [19]. In 2007 Aghaloo and Moy also tried to find reliable advantages for implant-based osteoplasty [20]. They did not find reliable advantages for any material and described the augmentation process as mainly technique-sensitive. The study of Ghanaati et al. also investigated the success rates of BioOss® for bone regeneration in the sinus cavity in oral cancer patients [21]. They found sufficient success rates for BioOss® as well as for synthetic Artoss Nano Bone® material, while BioOss® showed minimal superior results. Al Navas and Schiegnitz published an metaanalysis in 2014 that investigated the difference between autogenous bone and bone substitute materials [22]. In their opinion, there is no difference between both materials although influence factors could not be evaluated. A study of Lutz et al. from 2015 also investigated BioOss® and autogenous bone as augmentation materials for altogether 168 inserted implants over a 5 years period [23]. They also described both materials as the augmentation process as mainly technique-sensitive. The study of Ghanaati et al. also investigated the success rates of BioOss® for bone regeneration in the sinus cavity in oral cancer patients [21]. They found sufficient success rates for BioOss® as well as for synthetic Artoss Nano Bone® material, while BioOss® showed minimal superior results. Al Navas and Schiegnitz published an metaanalysis in 2014 that investigated the difference between autogenous bone and bone substitute materials [22]. In their opinion, there is no difference between both materials although influence factors could not be evaluated. A study of Lutz et al. from 2015 also investigated BioOss® and autogenous bone as augmentation materials for altogether 168 inserted implants over a 5 years period [23]. They also described both materials as

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<th>groups and subgroups</th>
<th>number of patients</th>
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<th>average age (median)</th>
<th>performed sinuses lifts</th>
<th>inserted implants</th>
</tr>
</thead>
<tbody>
<tr>
<td>total (reference)</td>
<td>148 patients</td>
<td>78 female (52.7%) 70 male (47.3%)</td>
<td>56.5 years (median 58.5)</td>
<td>241 sinuses 153 i.i.p. 88 d.i.p.</td>
<td>666</td>
</tr>
<tr>
<td>perforation</td>
<td>48 patients</td>
<td>22 female (45.8%) 26 male (54.2%)</td>
<td>52.9 years (median 57)</td>
<td>59 sinuses 33 i.i.p. 26 d.i.p.</td>
<td>152</td>
</tr>
<tr>
<td>auto- and xenogenous material</td>
<td>38 patients</td>
<td>19 female (50.0%) 19 male (50.0%)</td>
<td>51.5 years (median 63)</td>
<td>47 sinuses 23 i.i.p. 24 d.i.p.</td>
<td>129</td>
</tr>
<tr>
<td>smokers</td>
<td>17 patients</td>
<td>10 female (58.8%) 7 male (41.2%)</td>
<td>46.6 years (median 52)</td>
<td>22 sinuses 8 i.i.p. 14 d.i.p.</td>
<td>57</td>
</tr>
<tr>
<td>non-smokers</td>
<td>21 patients</td>
<td>9 female (42.9%) 12 male (57.1%)</td>
<td>49.1 years (median 58)</td>
<td>25 sinuses 15 i.i.p. 10 d.i.p.</td>
<td>72</td>
</tr>
<tr>
<td>pure xenogenous material</td>
<td>10 patients</td>
<td>3 female (30.0%) 7 male (70.0%)</td>
<td>44.9 years (median 64.5)</td>
<td>12 sinuses 10 i.i.p. 2 d.i.p.</td>
<td>23</td>
</tr>
<tr>
<td>smokers</td>
<td>2 patients</td>
<td>none 2 male (100.0%)</td>
<td>40.5 years (median 57)</td>
<td>3 sinuses 1 i.i.p. 2 d.i.p.</td>
<td>7</td>
</tr>
<tr>
<td>non-smokers</td>
<td>8 patients</td>
<td>3 female (37.5%) 5 male (62.5%)</td>
<td>45.0 years (median 65)</td>
<td>9 sinuses 9 i.i.p. 0 d.i.p.</td>
<td>16</td>
</tr>
</tbody>
</table>

Table 2: This table shows the patient-related data for perforated Schneiderian membranes. Like in table 1 the reference group is shown in grey in the first line. All groups with too small sample sizes are shown in the grey lines with results marked in red.
Summarizing all results and implant loss rates are shown for all stages with significances in brackets. The results that failed the significance level are written in red and excluded stages marked in grey.

Table 3: This table shows the results of our investigation for all unperforated sinus membranes and is conform to the patient groups of table 1. The upper line shows the reference group like in all other tables. Success and implant loss rates are shown for all stages

<table>
<thead>
<tr>
<th>groups and subgroups</th>
<th>success rates</th>
<th>implant loss rates</th>
<th>perforation occurrence</th>
</tr>
</thead>
<tbody>
<tr>
<td>total (reference)</td>
<td>94.2% (p&lt;0.001)</td>
<td>4.8% (p&lt;0.001)</td>
<td>24.5% (p&lt;0.001)</td>
</tr>
<tr>
<td>no perforation</td>
<td>95.6% (p&lt;0.001)</td>
<td>4.5% (p&lt;0.001)</td>
<td>23.0% (p&lt;0.001)</td>
</tr>
<tr>
<td>auto- and xenogenous material</td>
<td>95.6% (p&lt;0.001)</td>
<td>3.8% (p&lt;0.001)</td>
<td>16.0% (p&lt;0.001)</td>
</tr>
<tr>
<td>smokers</td>
<td>93.8% (p&lt;0.001)</td>
<td>9.7% (p&lt;0.001)</td>
<td>10.0% (p&lt;0.001)</td>
</tr>
<tr>
<td>non-smokers</td>
<td>96.4% (p&lt;0.001)</td>
<td>1.9% (p&lt;0.001)</td>
<td>6.0% (p&lt;0.001)</td>
</tr>
<tr>
<td>pure xenogenous material</td>
<td>95.0% (p&lt;0.001)</td>
<td>7.4% (p&lt;0.001)</td>
<td>7.0% (p&lt;0.001)</td>
</tr>
<tr>
<td>smokers</td>
<td>100.0% (p&lt;0.001)</td>
<td>8.7% (p&lt;0.001)</td>
<td>2.0% (p&lt;0.001)</td>
</tr>
<tr>
<td>non-smokers</td>
<td>93.3% (p&lt;0.001)</td>
<td>7.0% (p&lt;0.001)</td>
<td>5.0% (p&lt;0.001)</td>
</tr>
</tbody>
</table>

In the current literature, there is no consensus about advantages of the different augmentation materials. If the possibilities are given to perform an augmentation with autologous bone and without too high technical effort, this approach may offer a small but noticeable advantage of autologous bone.

In summary, the results of our study show a small but noticeable advantage of autologous bone and without too high technical effort, this approach may offer a small but noticeable advantage of autologous bone.

The study of Hatano et al. also investigated a great number of patients that were treated with a combination of autologous and xenogenous bone [24]. They had no comparison to other materials, but achieved a comparable implant survival rate to our study with 94.2%.

equivalent options. A clear and reliable answer to the question, which material is the best, is hard to find, because many factors influence the success of augmentation and implantation procedures. The results of our study show a small but noticeable advantage of autologous bone. Especially the implant survival can be improved by adding autologous bone. The study of Hatano et al. also investigated a great number of patients that were treated with a combination of autologous and xenogenous bone [24]. They had no comparison to other materials, but achieved a comparable implant survival rate to our study with 94.2%.

superiority of autologous bone seems to exist. Anyhow, also the augmented sinuses with pure BioOss® had sufficient success rates, so that no general recommendation can be defined. At least it should not be unmentioned that in our patients, only small cavities were treated with pure BioOss®. All larger cavities were additionally filled with autologous bone. This may also influences the results and may decreases the differences between both materials. The present literature has no consensus about advantages of the different augmentation materials. If the possibilities are given to perform an augmentation with autologous bone and without too high technical effort, this approach may offer a small but noticeable advantage of autologous bone.
### Table 4: Analogous to table 3 it shows all results for the perforated sinuses. The first line is taken as reference for easier comparison. Excluded results are written in red and marked in grey.

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<td></td>
<td>227 of 241 augmented sinususes</td>
<td>32 losses at 66 inserted implants</td>
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</tr>
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<td>perforation</td>
<td>89.8% (p&lt;0.001)</td>
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<td></td>
<td>53 of 59 augmented sinususes</td>
<td>9 losses at 152 inserted implants</td>
<td>11 perforations at 59 augmented sinuses</td>
</tr>
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<td>auto- and xenogenous material</td>
<td>89.4% (p&lt;0.001)</td>
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<td></td>
<td>42 of 47 augmented sinususes</td>
<td>7 losses at 129 inserted implants</td>
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<td>smokers</td>
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<td>91.7% (p&lt;0.001)</td>
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<td></td>
<td>11 of 12 augmented sinususes</td>
<td>2 losses at 23 inserted implants</td>
<td>7 perforations at 12 augmented sinuses</td>
</tr>
<tr>
<td>smokers</td>
<td>100.0% (p=0.205)</td>
<td>0.0% (p=0.090)</td>
<td>22.3% (p&lt;0.001)</td>
</tr>
<tr>
<td></td>
<td>3 of 3 augmented sinususes</td>
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<td>7 perforations at 3 augmented sinuses</td>
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<td>88.9% (p&lt;0.001)</td>
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<td>8 of 9 augmented sinususes</td>
<td>2 losses at 16 inserted implants</td>
<td>8 perforations at 9 augmented sinuses</td>
</tr>
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</table>

#### Conclusion

Especially for the implant survival, but also for the success of the sinus augmentation, a difference between autologous and xenogenous material was detected. The groups where a combination of autologous and xenogenous material was used achieved optimum results. It seems that a combination of autologous and xenogenous material combines two advantages. Xenogenous materials are more resistant against resorption and so have a supporting effect to the autologous material that would be superior in bone formation. The additional costs and expenses need to be weighted against the clinical improvements. This also can be an important point of patient consultation.

#### The Influence of Smoking

Like mentioned above, our results failed to yield sufficient and significant results that clearly show the influences of smoking on the prognosis of sinus lifts. This is mainly caused by the small sample sizes of the final differentiation groups where smokers and non-smokers are listed separately. Notwithstanding the results show that the lowest implant loss rates can be found for those patients who are non-smokers, where no perforation of the Schneiderian membrane occurred and autologous bone was used additionally (1.9% implant loss rate p<0.001).

The possibility should be used to get optimum results. It seems that a combination of autologous and xenogenous material combines two advantages. Xenogenous materials are more resistant against resorption and so have a supporting effect to the autologous material that would be superior in bone formation. The additional costs and expenses need to be weighted against the clinical improvements. This also can be an important point of patient consultation.

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xenogenous bone was used showed higher success rates for the sinus augmentation and lower implant loss rates (table 3 and 4). The use of pure xenogenous graft material should be considered when the bone harvesting is not possible, too expensive and uneconomic. For perfect results, the use of autologous material in combination with xenogenous material should be preferred.

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12th International Exhibition
Marina Bay Sands, Singapore

MEDICAL FAIR ASIA is well positioned to be the No.1 procurement stage for industry professionals to experience new and innovative technologies, solutions, products, and services. At the 2018 edition, new disruptive digital healthcare solutions such as remote and wireless healthcare, IT platforms, wearable devices, smarter medicine and healthcare analytics are also expected to be showcased by participating exhibitors. Focused on equipment and supplies for the hospital, diagnostic, pharmaceutical, medical and rehabilitation sectors, the event continues to raise the overall capabilities and spur the growth of the region’s medical and healthcare sectors to meet the changing demands in both the public and private sectors, driving the next wave of healthcare modernisation.

For more information please visit: www.medicalfair-asia.com

Medical Manufacturing Asia
Marina Bay Sands, Singapore
State-of-the-Art Technologies and Solutions for Medical Technology

For more information please visit: www.medmanufacturing-asia.com

Oman Health Exhibition & Conference
24.09. - 26.09.2018
Oman Health Exhibition & Conference is an annual international trade event that highlights the rapid and continuous advancements of the health and medical sector in Oman. It is a common platform that brings together different segments of the health and medical industry to explore new opportunities, showcase the latest technologies, services and facilities, and leverage potential for trade and investment.

The Conference is aligned with the government’s Health Vision 2050 and aimed at addressing the challenges as well as discussing initiatives to improve the sector.

For more information please visit: www.omanhealthexpo.com

UzMedExpo 2018
XI INTERNATIONAL HEALTHCARE EXHIBITION
Uzexpocentre, Tashkent, Uzbekistan

For more information please visit: ieg.uz/ru/exhibitions/uzmedexpo

3rd International Conference on Physicians and Surgeons
Toronto, Canada

For more information please visit: physician-surgeons.cmesociety.com/
Trade Fair and Congress Partners

BIHE
24th Azerbaijan International Healthcare Exhibition

BIHE, the largest healthcare event in the Caucasus and the only specialised exhibition in Azerbaijan, is a wonderful opportunity to present your medical products and services to the region, find new potential partners and strengthen existing connections, expand and enter new emerging market. BIHE proved to be a launch pad into the Azerbaijan market for many companies. The exhibition includes a number of additional events, including conferences and workshops.

For more information please visit: www.bihe.az

The Saudi International Medlab Expo
19.11. - 21.11.2018

Riyadh International Convention and Exhibition Center

For more information please visit: www.saudimedlabexpo.com

Saudi International Pharma Expo
19.11. - 21.11.2018

Riyadh International Convention and Exhibition Center

For more information please visit: www.saudipharmaexpo.com

IMF International Medical Forum
17.04. - 19.04.2019

Medicine Innovations
International Exhibition
Kyiv, Ukraine

For more information please visit: medforum.in.ua

KIHE
25th International Healthcare Exhibition
15.05. - 17.05.2019

Atakent Exhibition Centre, Almaty, Kazakhstan

For more information please visit: www.kihe.kz

Iran Health
International Exhibition
June 2019

Teheran, Iran

For more information please visit: eniranhealthexhibition.org
Saudi International Pharma & Med Lab Expo

10 - 12 Rabea Alawal 1440 AH
19 - 21 November 2018
Riyadh International Conference & Exhibition Center
Riyadh - Saudi Arabia Center

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