The main aim of this thesis was to contribute to the diagnostics of SI joint pain. We performed anatomical and clinical research next to a systematic literature review regarding diagnostic criteria for SI joint pain. With the anatomical research we wanted to find out which structures contribute to SI joint pain, and for this reason we have searched for nociceptors in SI joint. With the clinical study we wanted to gain more insight in validity of the diagnostic criteria for SI joint pain.

In chapter 1 we describe the general information regarding SI joint pain and the diagnostic problems involved, followed by the aim and outline of this thesis.

In chapter 2 and 3 we describe the findings of the anatomical and immuno-histochemical studies. These studies were performed to find out the distribution of nerves and nociceptors in SI joint. Next to anatomical dissection, immunohistochemistry for calcitonin gene-related peptide (CGRP), substance P, tyrosine-hydroxylase (TH) and non-phosphorylated neurofilament (SMI-32) was used. The tissue was obtained from the anterior and interosseous sacroiliac ligaments (chapter 2), iliac and sacral cartilage, and subchondral bone (chapter 3). The microscopic examination of stained sections revealed the presence of CGRP and substance P immunoreactive structures. Thick bundles were found in dense and loose connective tissue. Single nerve fibers were observed in the dense connective tissue and next to blood vessels. Based on their morphologic features, these immunoreactive structures were classified as receptors type IV. Additionally, type II receptors were found in anterior and interosseous ligaments, which contained CGRP or substance P immunoreactive free nerve endings. The substance P and CGRP immunoreactivity was also observed in the superficial layer of sacral and iliac cartilage, and the adjacent ligamentous structures. Perivascular nerve bundles in the loose connective tissue of anterior sacroiliac ligament were stained with TH and SMI-32, and were 65-120μm and 40-100μm thick respectively. Blood vessels stained positive for TH but negative with SMI-32 antisera. These findings suggest, that the SI joint pain may originate from intra- and peri-articular structures, and provide the basis for a (positive) response to the intra- and peri-articular infiltration of local anesthetic.

Chapter 4 describes the results of systematic literature review of the diagnostic validity
of criteria for SI joint pain proposed by the International Association for the Study of Pain (IASP). A search was performed in PubMed, EMBASE and CINAHL databases up to September 2007. The quality of the studies was assessed. Sensitivity, specificity and diagnostic odds ratios were calculated for each diagnostic test. Statistical pooling was conducted for results of SI joint pain provocation tests. Seventeen studies were included. Six studies evaluated pain mapping, pain area or pain referrals from the SI joint, which could be ascribed to the evaluation of the first IASP criterion. Six studies assessed the accuracy of pain provocation or stressing tests, the second IASP criterion. One study evaluated the role of different contributors to low back pain, based on physical examination and positive outcome of various diagnostic infiltrations. Additionally, ten studies evaluated other kinds of clinical examination, such as the value of clinical history and mobilization tests, mechanical examination of the lumbar spine, pain provocation arthrography and bone scintigraphy. None of the studies evaluated the diagnostic validity of the SI joint infiltration, or the diagnostic validity of the IASP criteria set as a whole. In all studies the SI joint intra-articular infiltration was used as a reference test, however, the technique, the used medications and the required pain relief following the infiltration varied substantially between the studies. Regarding the diagnostic value of the first IASP criterion, pointing out the area adjacent to the superior posterior iliac spine, has reasonable specificity and sensitivity. Taking the double intra-articular infiltration technique as reference test, the pooled data of the thigh thrust test, compression test and 3 or more positive stressing tests showed discriminative power for diagnosing SI joint pain. From our meta-analysis we concluded, that the thigh thrust test, the compression test and 3 or more positive stressing tests have discriminative power for diagnosing SI joint pain. Furthermore, as a gold standard for SI joint pain diagnosis is lacking, the diagnostic validity of tests related to the IASP’s criteria for SI joint pain should be regarded with care and studied further.

In chapter 5 we describe the inter-examiner reliability of pressure algometry using a manual dynamometer, and the normal values for the pain pressure thresholds (PPT) in the SI joint region in healthy volunteers, and patients with SI joint pain. Forty-one healthy volunteers and 31 patients diagnosed with SI joint pain were included. The PPT’s of healthy subjects were compared to those measured in patients with SI joint pain on the affected side. We found moderate to good inter-rater reliability of the PPT's,
which varied between measured points. Median PPT’s measured in patients with SI joint pain were significantly lower compared to healthy volunteers. From this study we concluded, that manual algometry for the SI joint region appeared to be reliable in healthy volunteers, and to establish differences in pain pressure thresholds between healthy subjects and patients with SIJ pain.

In **chapter 6** the distribution of the injected medications in the SI joint in human cadavers is presented. For this purpose, SI joint were visualized under fluoroscopy and approached from three different infiltration points: caudally, cranially and in the middle segment of the dorsal part of the SI joint. Antero-posterior, oblique and lateral radiographs were taken, and a post-arthrography CT scan was made. The contrast medium injected via the caudo-dorsal approach reached the synovial part of the SI joint, but a leakage to the sciatic nerve and piriformis muscle was recorded in all cases. With the cranio-dorsal approach, a small portion of the contrast medium was seen in the cranial part of the dorsal ligament, but also a significant spread was seen in the multifidus muscle and to the ipsilateral foramina L4 and L5. The medial approach resulted in the superficial spreading of the dorsal SI joint ligament. In 3 of the specimens a significant intravascular deposition of contrast medium was seen. We concluded, that the dorso-caudal approach to the SI joint reaches particularly the synovial, whereas the cranial and middle approach reaches the extra-synovial part of the SI joint.

In **chapter 7** we describe the effectiveness of three different medications injected intra-articularly, i.e. in the synovial part of the SI joint, studied in a prospective, randomized, placebo controlled trial. Patients, with pain the SI joint region, and a positive result of three or more SI joint provocation tests were included. Patients were randomly assigned to one of the treatment groups: lidocaine, lidocaine plus DepoMedrol (DM) or NaCl 0.9% (saline). The primary outcome measure was pain reduction. Secondary outcome measures included the Oswestry Diasability Index (ODI), Roland-Morris Disability Questionnaire (RM), COOP – WONCA (CW) and SF36, the duration of clinically relevant pain relief, and medication use. Thirty-four patients were included. Mean pain relief after the infiltration was overall moderate, and highest in de lidocaine- DM group. Improvements on different outcome measures were in general moderate, and
differences found between treatment groups were inconsistent with regard to effect size and duration. However, if at all, improvements were observed in the lidocaine-DM group. Taking the small sample size of this study into consideration, we conclude that this study provides some indications, that infiltration with lidocaine-DM is superior for pain relief compared to placebo and lidocaine.

Chapter 8 is a summary of the present knowledge regarding SI joint pain. It gives guidelines for pain physicians about how to make a diagnosis of SI joint pain and how to treat it. It is emphasized, that the treatment of SI joint pain is best performed in the context of a multidisciplinary approach, whereby conservative treatments address the underlying causes and consist of exercise therapy and manipulation. Regarding the invasive therapies, the intra-articular SI joint infiltrations with local anesthetic and corticosteroids hold the highest evidence rating. If the latter fail or produce only short-term effects, cooled radiofrequency treatment of the lateral branches of S1 to S3, (S4) is recommended if available. When this procedure cannot be used (pulsed) radiofrequency procedures targeted at L5 dorsal ramus and lateral branches of S1 to S3 may be considered.

In chapter 9, the main findings of this thesis are discussed and placed into context, and suggestions for further research are presented.