**Resumé**

**Clinimetrics of Sonoelastography - a new method for detection of abnormalities in the Supraspinatus tendon and evaluation of its reliability, diagnostic value and responsiveness**

Musculoskeletal disorders constitute the largest group of work related problems. The prevalence of subjects with shoulder problems is common, with lifetime prevalence in the general population of about 30-50%. Most of the shoulder disorders are treated non-pharmacologically and non-invasively, but the scientific evidence for such treatments is often almost non-existing. This may either be due to non-effective treatments and/or use of diagnostic and outcome measures with poor clinimetric properties. This PhD-project deals with methods aiming at improving clinimetric properties of an Ultrasound method for diagnosing musculoskeletal shoulders disorders, as well as for measuring the effect of treatment.

Ultrasonic Elastography (SEL) is a relatively new and not yet well-established method representing one of the paraclinical methods. With this method the physical properties of soft tissue are revealed through characterization of the differences in stiffness between the tissues. In regard to nomenclature, pressure application and image display, that there is generally some inconsistency. Thus, there is a need to standardize procedures for SEL and to test the reliability of this method.

It is anticipated that tendinopathy leads to changes in tissue elasticity, probably due to histopathological alterations, resulting in softening of the intratendinous tissue and a more heterogeneous tendon than in healthy controls. Since tendinopathy of the rotator cuff is considered one of the most frequent causes of pain and dysfunction in the shoulder, it is relevant to study whether SEL can detect differences of tissue characteristics in subjects with Supraspinatus tendinopathy and healthy controls. During rehabilitation and exercising it is anticipated that connective tissues undergo mechanical changes. SEL has been able to detect changes in the elbow flexor muscles after series of training where the muscles became harder. Since there are no studies exploring SELs ability to detect changes in the Supraspinatus tendon, it is relevant to study the sensitivity to change in SEL in Supraspinatus tendinopathy after intensive training.

To sum up the aim of this study is therefore to test the reliability and validity of SEL in the Supraspinatus tendon, and furthermore the sensitivity to change. Few studies have reported elasticity characteristics of the shoulder by sonoelastography but a recent review indicates that SEL is a promising tool and may become a complementary imaging technique for the assessment of musculoskeletal disorders in the shoulder, equal to or potentially superior to conventional US and MRI. This PhD-study will provide new knowledge on SEL for use on the shoulder, and increase the possibilities for evidence based treatment of patients with shoulder disorders.
Clinimetrics of Sonoelastography - a new method for detection of abnormalities in the Supraspinatus tendon and evaluation of its reliability, diagnostic value and responsiveness

Introduction
Musculoskeletal disorders constitute the largest group of work related problems, with a large expense at society on sickness absence, especially due to neck-shoulder problems (Carroll et al., 2009). The prevalence of subjects with shoulder problems is common, with a lifetime prevalence in the general population of about 30-50% (Lewis, 2009). Most of the shoulder disorders are treated non-pharmacologically and non-invasively, but the scientific evidence for such treatments is often almost non-existing (Gibson et al., 2004). This may either be due to non-effective treatments and/or use of diagnostic and outcome measures with poor clinimetric properties. This PhD-project deals with methods aiming at improving clinimetric properties of an Ultrasound method for diagnosing musculoskeletal shoulders disorders, as well as for measuring the effect of treatment.

Use of ultrasound (US) has increased in the last decade, and new technologies connected to this method have been developed. One of them is the Ultrasonic Elastography, a relatively new and not yet well-established method, representing one of the para-clinical methods. With this method the physical properties of soft tissue are revealed through characterization of the differences in stiffness between the region of interest and the surrounding tissue. The most commonly used US elastography technique is compression induced through a handheld US transducer (De Zordo et al., 2010, De Zordo et al., 2009a, De Zordo et al., 2009b, Drakonaki et al., 2009, Klauser et al., 2010, Sconfienza et al., 2010). This technique is referred to as Sonoelastography (SEL) (Sconfienza et al., 2010), with other names like freehand SEL (Klauser et al., 2010), elastography (Garra, 2011), real-time SEL (Klauser and Peetrons, 2009), and compression elastography/strain imaging (Taylor et al., 2000). The tissue differences are obtained on the basis of uniformly, mechanically induced deformation (strain) of structures during the conventional B-mode US-scan. Through manual compression the tissue region of interest displays induced deformation, and the degree of deformation of the underlying soft tissue is calculated to estimate the tissue stiffness (Itoh et al., 2006, Thomas et al., 2006). The elasticity of the tissue is expressed by the equation: Y = stress / strain, where Y (Young’s modulus) is a measure of the elasticity, stress is the externally applied force and strain is the deformation of the tissue. A quality indicator gives visual feedback on the compression technique (GE, 2012). Other more indirect methods, like propagation of shearwaves elasticity (SWE) can also be used to assess elasticity (Peltz et al., 2013).

SEL has primarily been established for differentiating malignant from benign lesions of the breast, thyroid, prostate, and lymph node (Alam et al., 2008, Asteria et al., 2008, Itoh et al., 2006, Pallwein et al., 2007, Rubaitelli et al., 2009, Zhu et al., 2008), but use of SEL has increased to include musculoskeletal conditions as well (Drakonaki et al., 2012, Pedersen et al., 2012). In the musculoskeletal system in vivo elasticity measurements of the involved tissue can give valuable noninvasive information for diagnosing and effect measuring of pathologic conditions, e.g. related to inflammation and hereditary diseases where tissue elasticity is known to differ from the normal tissue. The ability of SEL to differ between pathological (soft or hard) tissues, in addition to measuring the effect of changes is thus important.
An inflammatory condition such as the tendinopathy, defined as a continuum of different stages of tendon overuse and degeneration (Jozsa et al., 1982, Sharma and Maffulli, 2006), has been diagnosed by SEL in several other body regions than the shoulder, e.g. the Achilles (De Zordo et al., 2010, Drakonaki et al., 2009, Drakonaki et al., 2012, Klauser et al., 2013, Sconfienza et al., 2010, Tan et al., 2012), the patella (Rist and
Mauch, 2012), and the elbow (De Zordo et al., 2009b). Only two studies have evaluated the Supraspinatus tendon, in healthy (Arda et al., 2011) and in subjects with teared Supraspinatus tendon (Tudisco et al., 2013). No case-control study has evaluated the Supraspinatus tendinopathy with SEL. In regard to nomenclature, pressure application and image display, that there is generally some inconsistency (Bamber et al., 2013). Thus, there is a need to standardize procedures for SEL and to test the reliability of this method in the Supraspinatus tendon (study 1).

It is anticipated that tendinopathy leads to changes in tissue elasticity, probably due to histopathological alterations, resulting in softening of the intratendinous tissue (De Zordo et al., 2010) and a more heterogeneous tendon than in healthy controls (Tan et al., 2012). Since tendinopathy of the rotator cuff is considered one of the most frequent causes of pain and dysfunction in the shoulder, it is relevant to study whether SEL can detect differences of tissue characteristics in subjects with Supraspinatus tendinopathy and healthy controls (study 2).

During rehabilitation and exercising it is anticipated that connective tissues undergo mechanical changes. SEL has been able to detect changes in the elbow flexor muscles after series of training where the muscles became harder (Niitsu et al., 2011). Since there are no studies exploring SELs ability to detect changes in the Supraspinatus tendon, it is relevant to study the sensitivity to change in SEL in Supraspinatus tendinopathy after intensive training (study 3).

In relation to hereditary soft tissues, exceptionally soft skin and connective tissues are seen, e.g. in the Ehlers-Danlos hypermobile type (EDS-HT), with increased skin extensibility, elasticity and softness of the forearm (Remvig et al., 2010, Remvig et al., 2009), and decreased passive resistance of the ankle (Rombaut et al., 2012). Since EDS-HT patients often present with laxity in the shoulder, like Multidirectional instability (MDI) (Cameron et al., 2010, Lee et al., 2013), it is anticipated that subjects with shoulder MDI will display Supraspinatus tendon tissue with larger softness than those of the healthy controls. It is therefore relevant to study whether SEL can detect differences of tissue characteristics in the Supraspinatus tendon in subjects with shoulder MDI and healthy controls. However, since no study has used SEL in this patient group to measure elasticity properties, this project will be explorative (study 4).

Aims
The aim of this project is
(1) to develop a SEL protocol for assessment of the Supraspinatus tendon, and to test the reliability of SEL in detecting abnormalities within the Supraspinatus tendon.
(2) to test the discriminative validity of SEL in the normal and abnormal/pathological Supraspinatus tendon due to tendinopathy
(3) to test the sensitivity to change in the Supraspinatus tendon (before/after training)
(4) to test exploratively, the discriminative validity of SEL in the normal and abnormal/pathological Supraspinatus tendon due to MDI.

Methods and population
All procedures will be performed by the Ph.D. student who will receive training in the radiology department, Vejle Hospital. An identical program is used for orthopedic surgeons and rheumatologists among others. This will be followed by 40 radiologist-approved examinations of the shoulder. In study 1 the examinations will also be performed by radiologist John Hjarbaek (supervisor).

Participants
Study 1 - Reliability
An intra- and inter tester reliability study will be performed according to a 3-phased study protocol for reproducibility and validity studies of diagnostic procedures (Patijn, 2004).
**Patient population:** Men and women with normal and abnormal Supraspinatus tendons, with a variety of tendon characteristics (asymptomatic, tendinopathy, MDI). Recruitment for participation is performed from the shoulder sector Vejle Hospital (Sygehus Lillebaelt), Svendborg hospital (Odense University hospital), Esbjerg hospital and Aalborg hospital. Primarily the participants will be recruited from Odense, Vejle and the corresponding area, since to our knowledge there is no existing portable ultrasound device with elastography. Quantitative and qualitative measurements are performed to investigate the intra- and intertester reliability of this newly developed SEL protocol in the Supraspinatus tendon.

**Study 2 - Discriminative validity**
Healthy group matched on gender, age and BMI to groups with abnormal SEL characteristics.  
**Patient population A:** Healthy population matched to population B.  
**Patient population B:** Patients diagnosed with Supraspinatus tendinopathy based on clinical tests and ultrasound. Recruitment of participation is performed from the shoulder sector Vejle Hospital (Sygehus Lillebaelt) and Svendborg hospital (Odense University hospital). Patient groups B is involved in another current PhD-project during 2014 and 2015, and thereby available in this project.

**Study 3 - Responsiveness**
**Patient population:** From study 2 (patient group B). The patients perform 12 weeks of non-operative training, based on high-load progressive principles of exercises for training the Supraspinatus tendon and the scapula/glenohumeral muscles.

**Study 4 - Discriminative validity (explorative)**
Healthy group matched on gender, age and BMI to groups with abnormal SEL characteristics.  
**Patient population A:** Healthy population matched to population C.  
**Patient population C:** Patients diagnosed with MDI. Recruitment for participation is performed from Esbjerg hospital, Svendborg hospital and Aalborg hospital. Patient group C is involved in another current PhD-project during 2014 and 2015, and thereby available in this project.

**Outcome measures**

**Procedures**
For all four studies the mentioned ultrasonic measurements below, will be used. A protocol with standardised procedures will be developed for detection of SEL characteristics in the Supraspinatus tendon. Available SEL equipment is currently the GE LOGIQ S7, fitted with the dedicated probe ML6-15(-D). In all studies SEL measurements will be based on examination of entire cine-loops rather than on single static images, in order to minimize intra-observer variation and avoid transient temporal fluctuations. A total of three compression-relaxation cycles will be saved (De Zordo et al., 2010, De Zordo et al., 2009a, Drakonaki et al., 2009, Klauser et al., 2010). The best elastogram with a minimal amount of artefacts like e.g. movements will be selected for evaluation of the qualitative measurement, while a mean of three measurements will be calculated for the semi-quantitative data. The Supraspinatus tendon and muscle elasticity values are obtained with the patient sitting in the erect position with the forearm behind the back and elbow flexed to 90° with the palm facing in the posterior direction, as previously described (Tudisco et al., 2013). Quantitatively, the images produced do not directly depict the elasticity. The reasons are mainly because of the difficulty of measuring the amount of stress within the tissue that is due to the force applied on the surface. However, regions of interest (ROI) can be drawn over target areas in the screen and over an adjacent reference region, with a reference of normal tissue, experiencing the same stress as the target
region. The exact value and the ratio will be calculated to provide a semi-quantitative analysis (Cosgrove et al., 2013). A total of three reference values will be used, including a region of fat (Drakonaki et al., 2009), a region of bone (Tudisco et al., 2013) and a region in a gel pad placed above the area of interest, which provides a more homogeneous reference (Niitsu et al., 2011).

Qualitatively, the tendon will be classified with a value on a scale from 1-4, according to the following elasticity features: type 1, blue (hardest tissue); type 2, blue/green (hard tissue), type 3, green (intermediate tissue); or type 4, red (soft tissue), since the reproducibility of this method has been found to be good to excellent (De Zordo et al., 2010, Drakonaki et al., 2009). In addition, three subtypes are determined as homogeneous (a), relatively homogeneous (b), and heterogeneous (c) (Tan et al., 2012).

For all studies the examiners will be blinded to the patient’s clinical findings/symptoms and in addition blinded to the ratios, which are normally seen on the screen.

The B-mode picture does not function as a gold standard, but serves the need to find the anatomically best scan plan. Furthermore, the B-mode picture does not determine if a participant is a case or a control, since ruptured tendons can be both symptomatic and asymptomatic, and so can non-ruptured tendons. The inclusion of participants will be determined by clinical tests and self reported pain.

As described earlier, there are a number of factors that affect the colour coding on the elastogram, although all but one (pressure) is met by visual feedback from the device. In a pilot study the pressure, by which the transducer is placed on the skin, will be standardized by a proper amount of training. If this fails, a force gauge will be applied to the transducer to ensure uniformity.

**Secondary outcomes**
Secondary outcomes include identification of Fibrillar disruption, Tendon swelling, and calcification, measured on greyscale, and Neovascularization in the Supraspinatus tendon measured on power Doppler (Poltawski et al., 2012). These outcomes are used as inclusion criteria as well.

Muscle force will be measured in active flexion, abduction and internal/external rotation of the gleno-humeral joint with a digital strain gauge.

**Questionnaires**
Participants will be asked to fill out questionnaires on demographics, including information on age, gender, BMI, current work situation, annual salary, marital status, duration and origins of pain. The Short Form (36) Health Survey which is a patient-reported survey of patient health will also be used.

For evaluating the effect of treatment (study 3) DASH (Disabilities of the Arm, Shoulder and Hand), which investigates disability of the upper extremities, VAS, which assesses pain level, EQ-5D, which measures the patients’ health-related quality of life and Shoulder injury and Osteoarthritis Outcome Score (SOOS) which measure shoulder function, will be used.

**Statistical analysis**
Statistical analysis is performed with SPSS software (release 13.0, SPSS). Standard descriptive statistics is used to summarize characteristics of the patients and healthy volunteers, including median and SD for the continuous variables, and counts and percentages for the categorical variables. Continuous variables are compared between patients and controls by using the Mann-Whitney U test, and categorical variables by using the Fisher’s exact test.

The intra- and inter-observer agreement and reproducibility are assessed by use of Bland-Altman plots, calculation of Limits of agreement, SEM and MDC (minimal detectable change), and ICC (intra-class correlation coefficient). A repeated-measured ANOVA (mixed model) is used to assess the potential change in the strain ratios produced after the intervention in study C.
Power calculation

A pilot study, with 10 healthy participants and 10 patients, will be used in order to develop procedures and standardize interpretation of results in the protocol.

Classic power calculations based on the Supraspinatus tendon have not been made since we have no knowledge regarding means and standard deviations. However, attempts for estimation of sample size have been performed for all sub studies, as described in the following.

Study 1 - Reliability (n=70)

This study will function as a reference study and aims to investigate the feasibility and reproducibility of the non-symptomatic Supraspinatus tendon using SEL. One study describing the Achilles tendons included fifty tendons and found a variance of 7.5% (SD: 2%) using the strain ratio method (Drakonaki et al., 2009). It is, however, not possible to make a precise power calculation, but according to the 3-phased protocol for reliability studies (Patijn, 2004), 10 subjects are recommended for phase 1, 20 subjects for phase 2, and 40 subjects for phase 3.

Study 2 - Discriminative validity (n=2x36)

One study with 32 consecutively registered patients with lateral epicondylitis and 44 asymptomatic healthy volunteers showed a significant difference between the groups, measured on a four-level scale used to measure the degree of focal lesions. In the healthy subjects hard tendon structures were seen in the majority of the tendon thirds (96%), with mild alterations seen in a very small part (4%) of these. In contrast, the patients showed hard structures in only a smaller part (33%) of tendon thirds, with softening structures in the majority (67%) of these (De Zordo et al., 2009b). Another study of asymptomatic controls (n=97) and patients with lateral epicondylitis (n=89) found a statistically difference in the strain ratio (22%), indicating that the symptomatic tendons were softer (Ahn et al., 2014). Based on a difference of 20% and a variance of 30% this study will need 36 participants in each group, to detect a change with a power of 80%, and a significance level of 5%.

Study 3 - Responsiveness (n=106)

This study will investigate SELs ability to detect a change in the Supraspinatus tendon suffering from tendinopathy. Since this is the first of its kind, it is not possible to conduct a precise power calculation. However, one study conducted on rabbits (n=9) found that it was possible to monitor the change of elasticity due to injured Achilles tendons using SEL (Gehmert et al., 2012). Another study on humans (n=5) showed a significantly increase in muscle hardness in the elbow flexor muscles (measured in ratios) immediately after training from 83% (SD 2%) to 69% (SD 7%). The values of the non-exercised control arm did not change significantly (Niitsu et al., 2011). Based on a change of 20% and a variance of 30% we will need 96 subjects to detect a change, with a power of 90%, and a significance level of 5%. Adjusted for 10% drop-outs, the sample size will be a total of 106 subjects.

Study 4 - Discriminative validity (explorative) (n=2x11)

Based on previous measurements of soft tissue stiffness meters in healthy subjects and patients with EDS-HT (Remvig et al., 2009) including a 20% change and a variance of 20%, this explorative study will use a sample size of 11 subjects in each group.

Ethical aspects

The Scientific Ethical Committee for the Region of Southern Denmark has just announced that an approval from the ethics committee is not required for the current study. However, general ethical regulations will be followed according to the Helsinki declaration (Vollmann and Winau, 1996), application to The Scientific
Ethical Committee for the Region of Southern Denmark, data storing rules according to the Danish Data Protection Agency, and study registration at www.clinicaltrial.gov. All data will be published in international and national scientifically relevant journals, and all contributors will be offered authorship, following general Vancouver rules for publication. Both positive and negative results will be published. All patients will receive written information before entering the study, and informed consent regarding acceptance of participation, collection of medical records and data concerning sick days, will be obtained. Patients will be informed of their rights to leave the project at any time.

**Time schedule**
See appendix

**Publications**
Results will be published in relevant peer-reviewed international and national journals, targeting orthopedic surgeons, rheumatologists, general practitioners, physiotherapists, radiographers and radiologists.

1. Intra- and inter-tester reliability of Real-time sonoelastography of the normal and abnormal Supraspinatus tendon
2. Discriminative validity of Real-time sonoelastography of the Supraspinatus tendon: comparison of findings between patients with supraspinatus tendinopathy and healthy volunteers
3. Sensitivity to change of Real-time sonoelastography in monitoring the effect of training in patients with Supraspinatus tendinopathy
4. Discriminative validity of Real-time sonoelastography of the Supraspinatus tendon: comparison of findings between patients with MDI and healthy volunteers

**The new knowledge and organisation of the project**
The Supraspinatus tendon is well positioned for sonoelastographic examination and experience shows that scanning of even obese patients seem to present no problem in this region. Few studies have reported elasticity characteristics of the shoulder by SEL. A recent review (Pedersen et al., 2012) indicates that SEL is a promising tool and may become a complementary imaging technique for the assessment of musculoskeletal disorders in the shoulder, equal to or potentially superior to conventional US and MRI. This PhD-study will provide new knowledge on SEL for use on the shoulder, and increase the possibilities for evidence based treatment of patients with shoulder disorders.

Main supervisor of this Research project is Associate professor, PhD, Birgit Juul-Kristensen, University of Southern Denmark, while co-supervisors are consultant, radiologist John Hjarbaek, Department of Radiology, Odense University hospital, Associate Professor Per Kjær, PhD, Department of Sports Science and Clinical Biomechanics, University of Southern Denmark. Statistical expertise is available for the project.
References


GE 2012. Elastography: from concept to clinical applications.


Beskrivelse af forskningssamarbejdet

I forbindelse med ph.d. projektet “Clinimetrics of Sonoelastography - a new method for detection of abnormalities in the Supraspinatus tendon and evaluation of its reliability, diagnostic value and responsiveness” er der indgået et samarbejde mellem Syddansk Universitet i Odense (SDU), University College Lillebælt (UCL), Odense Universitetshospital (OUH) og Sygehus Lillebælt, Vejle. De deltagende parter er lektor Birgit Juul-Kristensen, Ph.d.-studerende Karen Brage, UCL, Overlæge og lektor John Hjarbæk, Radiologisk Afd, OUH og Overlæge Lilli Sørensen, Skuldersektoren, Ortopædkirurgisk afd., Vejle Sygehus.

Mange skulder problematikker behandles i dag konservativt, men evidensen for disse behandlinger er nærmest ikke eksisterende. Dette kan skyldes ineffektiv behandling og/eller brug af mangelfulde diagnostiske metoder. Dette projekt søger at optimere ultralyds klinimetriske egenskaber i forbindelse med diagnosticering af muskuloskeletale skuldersygdomme samt måling af en evt. behandlings effekt.

### Budget

**Projektleder**: Clinometrics of Sonoeastography - a new method for detection of abnormalities in the Seprapsin mute and evaluation of its reliability, diagnostic value and responsiveness

**Ansvarer**: Birgitte Helene Kristensen

**Projektleder**: Odense Universitetssygehus; Sygehus Lillebælt; Syddansk Universitet; University College Lillebælt

<table>
<thead>
<tr>
<th>Ph.d. projektet aftikles på deltid over 4 år</th>
<th>2015</th>
<th>2016</th>
<th>2017</th>
<th>2018</th>
<th>Total budget</th>
</tr>
</thead>
<tbody>
<tr>
<td>Løn</td>
<td>153200</td>
<td>304000</td>
<td>304000</td>
<td>153200</td>
<td>472000</td>
</tr>
<tr>
<td>VAT</td>
<td>870</td>
<td>870</td>
<td>870</td>
<td>870</td>
<td>3480</td>
</tr>
</tbody>
</table>

**Postforslag (pr. 20 stk.)**

| Overlæge (inklusion) (0,17*70+42+38) | 1695 | 1695 | 1695 | 1695 | 6780 |
| Sygeplejerske (inklusion) (0,17*70+38+38) | 780 | 780 | 780 | 780 | 3120 |
| Sekretær (0,5 time*70+20+10) | 2010 | 2010 | 2010 | 2010 | 8040 |
| Videnskabelig assistent, advokatsærlighed (0,5 time*70+20+10) | 2010 | 2010 | 2010 | 2010 | 8040 |
| **Studie 1 (pr. 20 stk.)** | | | | | |
| Overlæge (inklusion) (0,17*70+42+38) | 1870 | 1870 | 1870 | 1870 | 7480 |
| Sygeplejerske (inklusion) (0,17*70+38+38) | 780 | 780 | 780 | 780 | 3120 |
| Sekretær (0,5 time*70+20+10) | 2345 | 2345 | 2345 | 2345 | 9380 |
| Videnskabelig assistent, advokatsærlighed (0,5 time*70+20+10) | 2345 | 2345 | 2345 | 2345 | 9380 |
| **Studie 2 (pr. 20 stk.)** | | | | | |
| Overlæge (inklusion) (0,17*70+42+38) | 1926 | 1926 | 1926 | 1926 | 7704 |
| Sygeplejerske (inklusion) (0,17*70+38+38) | 784 | 784 | 784 | 784 | 3136 |
| Sekretær (0,5 time*70+20+10) | 2412 | 2412 | 2412 | 2412 | 9648 |
| Videnskabelig assistent, advokatsærlighed (0,5 time*70+20+10) | 2412 | 2412 | 2412 | 2412 | 9648 |
| **Studie 3 (pr. 100 stk.)** | | | | | |
| Overlæge (inklusion) (0,17*100+42+72) | 2835 | 2835 | 2835 | 2835 | 11340 |
| Sygeplejerske (inklusion) (0,17*100+38+38) | 780 | 780 | 780 | 780 | 3120 |
| Sekretær (0,5 time*100+20+10) | 3511 | 3511 | 3511 | 3511 | 14044 |
| Behandlingsresultater (3,5*100+20) | 24877 | 24877 | 24877 | 24877 | 99508 |
| Sekretær til behandlingsresultater (0,17*100+38+38) | 784 | 784 | 784 | 784 | 3136 |
| Videnskabelig assistent, advokatsærlighed, 2 besøg (0,5 time*100+20+10) | 7102 | 7102 | 7102 | 7102 | 28408 |
| **Studie 4 (pr. 20 stk.)** | | | | | |
| Overlæge (inklusion) (0,17*20+42+38) | 580 | 580 | 580 | 580 | 2320 |
| Sygeplejerske (inklusion) (0,17*20+38+38) | 246 | 246 | 246 | 246 | 984 |
| Sekretær (0,5 time*20+10) | 737 | 737 | 737 | 737 | 2948 |
| Videnskabelig assistent, advokatsærlighed (0,5 time*20+10) | 737 | 737 | 737 | 737 | 2948 |

**DRIFT**

| Transport palinier (20 stk. 60 besøg i alt) | 12606 | 12606 | 12606 | 12606 | 49224 |
| Studieafgift SDU | 60000 | 60000 | 60000 | 60000 | 240000 |
| **TOTAL** | 32606 | 32606 | 32606 | 32606 | 125804 |

**UDSTYR - APPARATUR**

| Værdi til operativ udstyrsudlejning (2 stk.) | 10790 | 10790 | 10790 | 10790 | 43160 |
| Digital vægt (2 stk.) | 6578 | 6578 | 6578 | 6578 | 26312 |
| Saltstrøm | 1000 | 1000 | 1000 | 1000 | 4000 |
| Håndteringer (inkl. 250+1 foreslæg) | 1550 | 1550 | 1550 | 1550 | 6200 |
| Utrykkingsgrad (inkl. 150+1 foreslæg) | 783 | 783 | 783 | 783 | 3132 |
| Ultrasounogrammodul Varior | 30000 | 30000 | 30000 | 30000 | 120000 |
| Isobus kraftmodul (inkl. 500+1 foreslæg) | 14500 | 14500 | 14500 | 14500 | 58000 |
| Træningsmaskiner (elektriske og vægter) | 30000 | 30000 | 30000 | 30000 | 120000 |
| **TOTAL** | 38518 | 38518 | 38518 | 38518 | 154072 |

**AUDIT**

| Konferencerejser og bagerie | 10000 | 10000 | 10000 | 10000 | 40000 |
| Språkprøvningen af 4 artikler | 12000 | 12000 | 12000 | 12000 | 48000 |
| Publikationssagbygger | 24000 | 24000 | 24000 | 24000 | 96000 |
| Udrundersag | 30000 | 30000 | 30000 | 30000 | 120000 |
| **TOTAL** | 102000 | 102000 | 102000 | 102000 | 408000 |

**Udviklings- og inventarstøtte fra Region Syddanmark**

| Total budget | 250800 | 523000 | 641144 | 120121 | 1993071 | 582000 | 383994 |
CV: Birgit Juul Kristensen

CPR:050557-1452, 1/3/14
E-mail: bjuel-kristensen@health.sdu.dk, tel:+45 6550 3412, Mobile Phone: +45 23440150
Private address: Østerbrogade 92, 4.1, DK-2100 Cph Ø, tel (private) 44660225

Current positions: Assoc. Prof., Research Unit of Musculoskeletal Function and Physiotherapy, Institute of Sports Science and Clinical Biomechanics, University of Southern Denmark, Campusvej 55, DK-5230 Odense M, Denmark; Professor (20%) University College of Bergen, Institute of Physiotherapy, Occupational Therapy and Radiography, Bergen, Norway.

MAIN FIELDS OF COMPETENCE

My professional competences are based on about 17 years of research within the preventive and clinical treatment area, incl. epidemiology, work physiology and biomechanics. Especially, functional capacity in adults and children, in addition to clinical field- and laboratory-studies with focus on neck-shoulder and generalised joint hypermobility, and how to optimize prevention and treatment, have been my primary areas. Since 1993 I have published 50 articles in peer-reviewed journals, (29 within the last 5 years), and further 7 are in revision or have been submitted. In total I have delivered 138 abstracts (oral or as posters) at international and danish congresses, and I have given 14 presentations as invited speaker, written 29 reports/book chapters, and been chairman at several international symposia. Since 2001 I have been project leader of 4 research projects, and in total I have received 15.3 bill. d.kr in economic funding.

ACADEMIC DEGREES AND EMPLOYMENTS

2013- Professor (20%) at University College of Bergen, Department of Health Science, Institute for Physiotherapy, Occupational Therapy and Radiography, Bergen, Norway, 2009- Associate professor, University of Southern Denmark, Institute of Sports Science and Clinical Biomechanics, Research Unit of Musculoskeletal Function and Physiotherapy, 2005-09 Employed as senior-researcher at Department of Rheumatology, Rigshospitalet, DK (part-time paid by funding), as post-doctor at University of Oslo, Section for Health Science, Norway (part-time), 2001-04

Employed as senior researcher at National Research Center for Work Environment (NRCWE), Cph, DK, 2001 Ph.D. from University of Lund (doctor in medical science, Dr.Philos.) with the thesis: ‘Observation Methods and Imaging Techniques – Assessments of physical exposure in repetitive work with focus on neck and upper extremities’, 1995 B.Sc. in PT, University of Lund, Institute of PT, Sweden, 1992-04 Employed at NRCWE, Department of Work Physiology, 1982-86 Ballerup-Herlev Occupational Health Service Center, OHS (leave 7mth. 1983-84 for studying in USA), 1986-92 Danish Labour Inspection Service, Department of Occupational Medicine, 1980-82 Frederiksberg hospital, 1980 Physiotherapist (PT) from University College of Copenhagen, Institute of Physiotherapy, Cph, DK.

REFEREE, EXPERT COMMITTEES, SUPERVISION, TEACHING

I have been opponent at 6 PhD-dissertations, have been external evaluator on 2 university positions, 2 international research applications, examiner/opponent on a number of master and bachelor theses at the following Universities: University of Lund, Sweden, University of Oslo, Trondheim and Bergen, Norway, University of Århus, Copenhagen and Southern Denmark. I have supervised a number of bachelor students, 24 groups of master students, and 10 PhD-students, of whom 2 have defended their thesis. Currently I am supervising 5 PhD-students as main supervisor and 3 as co-supervisor. Since 2004 I have lectured at 12 PhD courses, and at the following master education: Master of Public Health, Master of Health Science, Master of Rehabilitation, Medicine (master level), Master of Physiotherapy, at the following Universities of Århus, Copenhagen and Southern Denmark. I have been member of 3 expert committees in the Danish Ministry of Health regarding ‘Development of a generic model for working out national clinical guidelines’, and ‘Professional visitation guidelines for selected shoulder disorders’ and ‘Clinical guidelines for surgery and non-surgery in selected shoulder disorders’ (2011-13), and member of expert committee for revising diagnostic criteria of EDS-hypermobility (2013).

PEER REVIEWED SCIENTIFIC ARTICLES WITHIN THE LAST 5 YEARS


**CV: Karen Brage**

**Education**

2014 (oct) - Ph.d.-student, Sports Science and Biomekanics, SDU
2011-2013 Master of Health Science, University of Southern Denmark, Odense
2002-2006 Bachelor in Radiography, University College Lillebaelt, Odense

**Employment**

2014- Assistant professor at Education of Radiography, University College Lillebaelt,
2014- External examiner, Education of Radiography
2013-2014 Consultant at Conrad – Radiographic Knowledge Center, University College Lillebaelt
2011 Radiographer, MRI, Diagnostic Center, Horsens (parttime)
2010-2011 Radiographer, MRI, MRI-center, University Hospital, Århus
2008-2010 Radiographer, MRI, Thava Imaging, Middelfart
2006-2008 Radiographer, Diagnostic Center, Kolding

**Teaching activities**

2014- Lecturer at courses Ultrasound in Radiography.
2013-2014 Instructor at course ‘Advanced Research Methods’ Cand. in Physiotherapy, SDU
2013 Instructor at course ‘Applied Scientific Methods’ Cand. in Sports Science, SDU
2013-2014 Lecturer at courses ‘Statistic’, ‘Epidemiology’ and ‘MRI physics’ in Radiography. Supervisor for Bachelors in Radiography

**Courses**

2015 Assessment and evaluation of human muscle, nervous system and tendon-aponeurosis (5,4 ECTS), PhD school at the Faculty of Health Sciences, Odense
2014 Pre ph.d. course (2 ECTS), PhD school at the Faculty of Health Sciences, Odense
Danish Society of Ultrasound, annual meeting
Introduction to Health Research (0,7 ECTS), PhD school at the Faculty of Health Sciences, Odense
Musculoskeletal Ultrasound, Danish Society of Ultrasound, Skejby
Biomechanics and motor control (3,2 ECTS), PhD school at the Faculty of Health Sciences, Odense
2011 Qualifying course for Master of Health Science programme, University of Southern Denmark, Odense
MRI course 2 (Phillips and Herlev Hospital)
K-space (Section of MRI, Copenhagen University Hospital)
2008 MRI course 1 (Phillips and Herlev hospital)
2007 Multislice CT (Copenhagen University Hospital)
RAM (Multislice CT, Whole-body CT, Thorax diagnostics, Multislice CT in neuroradiology)
(Copenhagen University Hospital and Phillips)
2006        IV course (Vejle Hospital)
             Multi trauma (Kolding and Fredericia Hospital)
2005        Children and Radiography (Center for Higher Educational Institutions, Fyn)
             MRI in a development perspective (Center for Higher Educational Institutions, Fyn)

Participation in conferences and annual meetings
2015        Annual meeting of the Danish Society of elbow- and Shouldersurgery, Herlev, Dk
2014        Annual meetings of the Danish Society of Ultrasound, Aarhus, Dk
2014        The 6th annual meeting of the Danish Biomechanical Society, Odense, Dk
2013        Research and Management, University College Lillebaelt, Odense, Dk
2009        RSNA, Radiological Society of North America, Chicago, US

Scientific publications (article)

Scientific publications (abstract)

Oral presentation
Brage K, Hjarbaek J, Kjaer P, Juul-Kristensen B. ‘Reliability of sonoelastography to determine stiffness of the supraspinatus tendon in a healthy population - a pilot study’
Dansk Selskab for Skulder- og Albuekirurgi, årsmøde 2015

Scientific publications (poster)
Soendergaard Lis, Rasmussen Camilla, Eriksen Annegrethe, Brage Karen, 2015. Carotid artery stenosis degree and findings: a retrospective comparison of MRI and Doppler Ultrasonography, European Society of Radiology. 2015, Vienna

Brage K, Ris Hansen I, Falla D, Søgaard K, Juul-Kristensen B, 2014. Pain Education combined with Training Reduce Pain in Patients with Chronic Neck Pain more than Pain Education alone – a preliminary Randomised Controlled Trial, the 6th annual meeting of the danish biomechanical society. 2014, Odense, DK
CV: John Hjarbæk

Personlige data:

John Hjarbæk  Dragebakken 525, 5250 Odense SV

Ansættelser:

01.09.90 - 31.08.92: Undervisningsstilling i Radiologi, Odense Sygehus.

01.09.92 - 28.02.94: 1. reservelæge på Odense Sygehus, røntgenafdelingen

01.03.94 - 30.11.96: 1. reservelæge på Vejle Sygehus, røntgenafdelingen

01.12.96 – 31.10.01: Overenskomst ansat overlæge på Vejle og Give Sygehus, røntgenafdelingen

01.11.01 – 30.04.04: Overenskomst ansat overlæge på Svendborg Sygehus, røntgenafdelingen

01.05.04 – 31.07.05: Overenskomst ansat overlæge på Vejle og Give Sygehus, røntgenafdelingen

01.08.05-30.11.07: Overenskomst ansat overlæge ved Odense Universitetshospital, røntgenafdelingen

01.12.07-31.10.09: Overlæge ved THAVA Imaging, Middelfart

01.11.09-10.10.10 Lægefaglig direktør THAVA Imaging A/S

07.11.10 - aktuelt: Overlæge Muskuloskeletal afsnit Radiologisk afdeling Odense Universitetshospital

Forskning/Lektorat/Censorat:

01.08.83-01.04.88: Gæsteforsker ved Fysiologisk Institut, Odense Universitet.

01.08.93-31.08.95: Eksaminator/censor ved Radiografskolen, Odense sygehus.

12.03.93-31.01.96: Klinisk lektor ved Odense Universitet, ved fagområdet for Røntgendiagnostik. 

Feb.2003: Supervision, samt udførelse af UL- delen i forbindelse med forskningsprojekt ” En validitets vurdering af ultralydsmåling af m. multifidi på patienter med kroniske lænderygsmerter”, Institut for idræt og biomekanik Syddansk Universitet.

01.09.03-31.08.07: Ministeriel beskikket censor ved uddannelsen i klinisk biomekanik ved Syddansk Universitet.

01.09.04-aktuelt: Lektor ved SDU, Institut for Idræt og Biomekanik, sidste 3 år som ekstern lektor ved Klinisk Institut, SDU.

Undervisning (blandt andet):

13-14.01.92 Radiografskolen Odense sygehus, "Ultralyddiagnostik".

25-28.01.93 Radiografskolen, Odense sygehus, "Ultralyddiagnostik".

2013 - aktuelt: Tilknyttet UCL mhp. undervisning af Beskrivende Radiografer, samt undervisning i Muskuloskeletal Ultrasound

Publikationsliste:

1) HJARBÆK, J., CHRISTENSEN, P. & GRØNLUND, J.: "Transcutaneous measurements of the oxygen partial pressure using argon to correct
for the oxygen consumption of the probe".
2) J. Appl. Physiol. vol. 59, No. 2; 667, 1985 (Selected abstract).

2) HJARBÆK, J., CHRISTENSEN, P. & GRØNLUND, J.:
"A new low-temperature transcutaneous probe based on mass spectrometry for measurement of skin PO2".
"Relationship between transcutaneous probe temperature, PO2, PCO2 and the distribution of the skin perfusion".

10) TEISEN, H., HJARBÆK, J. & JENSEN, E. K.:
"Follow-up investigation of fresh lunate bone fracture".
2) Orthopedics/Rheumatology Digest 3, 26-27, 1991 (Selected abstract).

11) HJARBÆK, J., TEISEN, H. & DE HASS, I.:
"Meckel’s divertikul - Klinik - Diagnosis und Behandlung".

12) CHRISTENSEN, P., HJARBÆK, J., JENSEN, B. & GRØNLUND, J.:
"Measurement of transcutaneous PO2, PCO2 and skin blood flow at different probetemperatures using mass spectrometry".

13) HJARBÆK, J., KRISTENSEN, P. W. & HAUGE, P.:
"Spinal gas collection demonstrated by CT".

14) EGUND, N., FRIDEN, T., HJARBÆK, J., LINDSTRAND, A. & STOCHERUP, R.:
"Radiographic assessement of sagittal knee laxity in weightbearing - A study on anterior cruciate deficient knees".

15) ALBERTSEN, J., MENCKE, S., CHRISTENSEN, L., TEISEN, H. & HJARBÆK, J.:
"Capitate Bone Fracture Diagnosed by CT".

16) SKJØDT,T., HJARBÆK, J. & KILSGAARD, J.:
“Billeddiagnostik ved rygglidelser hos idrætsakte”
Dansk Sportmedicin nr. 1, 4. Årgang, Februar 2000.
CV: Lilli Sørensen

Personlige data
Lilli Sørensen
Privatadresse: Pomonavej 12, 7100 Vejle.
E. mail: lilli.soerensen@slb.regionsyddanmark.dk
Tlf. 7940 6796 (arbejde) 2714 9296 (mobil)

Uddannelse
Speciallæge i ortopædisk kirurgi december 1999.
Diplomlæge i Idrætsmedicin.
Certificeret Coach 2006.
Associate Certified Coach® 2008
Nuvarerende ansættelse
Nuværende ansættelse
Overlæge, Sektorchef, Skuldersektoren, Ortopædkirurgisk afdeling, Sygehus Lillebælt, Vejle

Videnskabelige publikationer
Lilli Sørensen: Bilateral symmetrisk stressfraktur af ulnae Ugeskrift For Læger 1992;26:1850Â­1.
Lilli Sørensen, Karen Elisabeth M. Ibsen: Purulent myofasciitis hos diabetiker efter vacuumstøvleterepi hos
Carsten Ernst, Lilli Sørensen, Niels Dieter Röck, Inge Hvass: Voldsbetingede skadestuehenvendelser.
Femårig opfølgning af undersøgelser fra 1981 og 1986 ved skadestuen i Esbjerg. Ugeskrift for læger
Per Riegels Nielsen, Lilli Sørensen, Henrik Morgen Andersen & Steen Lindeqvist: Boneloc cemented total hip
Søren Holm, Niels Dieter Röck, Lilli Sørensen & Karen Elisabeth M. Ibsen. Etiske problemer i skadestue
Lilli Sørensen, Søren Erik Larsen, Niels Dieter Röck: The epidemiology of sports injuries in school-aged
Søren Larsen, Lilli Sørensen, Niels Dieter Röck: Ikke altid behov for ”fremskudt skadestue” ved store
Olaf C. Larsen, Steen Christensen, Søren E. Larsen, Lilli Sørensen: Analyses of occupational injuries in
Lilli Sørensen, Søren Erik Larsen, Niels Dieter Röck: Sports injuries in school aged children. A study of
52-56.
Mogens Haug, Lilli Sørensen, Ole Dichmann: Anterior cruciate ligament reconstruction as a day case with
Lilli Sørensen, Thomas Skjødt, Ole Lyager Dichmann, Gerhardt Teichert.
Peroperative ultrasonographic guided marking of calcium deposits in the rotator cuff facilitates localization
Lilli Sørensen, Jette Vobbe, Jens Elers, Jørn Beckmann. Psychological profiling of shoulder patients in a Day Clinic. Submitted.

Kongresdeltagelse
Talrige nationale og internationale kongresser indenfor ortopædkirurgi, skulderkirurgi og idrætsmedicin

Medlemsskaber
Dansk Ortopædisk Selskab (DOS)
Dansk Idrætsmedicinsk Selskab (DIMS)
Dansk Selskab for Artroskopisk Kirurgi og Sportstraumatologi (SAKS)
Dansk Selskab for Skulder og Albue Kirurgi (DSAKS)
Samtykke for deltagelse: John Hjarbæk

Samtykke for deltagelse

Jeg overlæge John Hjarbæk bekræfter hermed, at jeg vil deltage i ph.d. studiet "Clinimetrics of Sonoelastography - a new method for detection of abnormalities in the Supraspinatus tendon and evaluation of its reliability, diagnostic value and responsiveness" som vejleder, supervisor på oplæring og som medundersøger i studie 1.

Dato: 10/4-15
John Hjarbæk
Kære Karen

Spændende undersøgelser. Vi kender John Hjarbæk som god kollega. 

Ja, vi vil gerne hjælpe dig med at inkludere patienter til studiet "Clinimetrics of Sonoelastography – a new method for detection of abnormalities in the Supraspinatus tendon and evaluation of its realiability, diagnostic value and responsiveness" fra Skuldersektoren på Vejle Sygehus.

Med venlig hilsen

Lilli Sørensen

Overlæge, Sektorchef, Skuldersektoren
Kvalitetsansvarlig overlæge
Ortopædkirurgisk afd, Vejle Sygehus
Certificeret Coach
Diplomlæge i Idrætsmedicin

Tlf. 7940 6796