

Technical and Clinical publications on ShearWave™ Elastography and Ultrafast Imaging

I - Technology

Peer reviewed articles in international journals.

1. Ultrafast compound imaging for 2-D motion vector estimation: application to transient elastography, M. Tanter, J. Bercoff, L. Sandrin, M. Fink, IEEE Trans Ultrason Ferroelectr Freq Control. 2002 Oct;49(10):1363-74.
2. Supersonic Shear Imaging: A New Technique for Soft Tissue Elasticity Mapping. Bercoff J. et al., IEEE Transactions on Ultrasonics, Ferroelectrics, and Frequency Control, Vol. 51, No. 4, April 2004.
3. Sonic boom in soft materials: The elastic Cerenkov effect, J. Bercoff, M. Tanter, M. Fink, Applied Physics Letters, vol. 84, pp. 2202-2204, 2004
4. Monitoring thermally-induced lesions with supersonic shear imaging, J. Bercoff, M. Pernot, M. Tanter, and M. Fink, Ultrason Imaging. 2004 Apr;26(2):71-84
5. Temperature estimation using ultrasonic spatial compound imaging, M. Pernot, M. Tanter, J. Bercoff, KR. Waters, M. Fink, IEEE Trans Ultrason Ferroelectr Freq Control. 2004 May;51(5):606-15.
6. The role of viscosity in the impulse diffraction field of elastic waves induced by the acoustic radiation force, J. Bercoff, M. Tanter, M. Muller, M. Fink, IEEE Trans Ultrason Ferroelectr Freq Control. 2004 Nov;51(11):1523-36.
7. Nonlinear viscoelastic properties of tissue assessed by ultrasound, R. Sinkus, J. Bercoff, M. Tanter, JL. Gennisson, C. El-Khoury, V. Servois, A. Tardivon, M. Fink, IEEE Trans Ultrason Ferroelectr Freq Control. 2006 Nov;53(11):2009-18.
8. Acoustoelasticity in soft solids: Assessment of the nonlinear shear modulus with the acoustic radiation force, J.-L. Gennisson, a M. Rénier, S. Catheline, C. Barrière, J. Bercoff, M. Tanter, and M. Fink, J. Acoust. Soc. Am. 122 [1]6, December 2007
9. Coherent plane-wave compounding for very high frame rate ultrasonography and transient elastography. Montaldo G, Tanter M, Bercoff J, Benec N, Fink M. IEEE Trans Ultrason Ferroelectr Freq Control. 2009 Mar;56(3):489-506.
10. Temperature dependence of the shear modulus of soft tissues assessed by ultrasound. Sapin-de Brosses E, Gennisson JL, Pernot M, Fink M, Tanter M., Phys Med Biol. 2010 Mar 21;55(6):1701-18. Epub 2010 Mar 2.
11. Ultrafast Compound Doppler Imaging: Providing Full Blood Flow Characterization. Bercoff J. et al. IEEE Transactions on Ultrasonics, Ferroelectrics, and Frequency Control, Vol. 58, No. 1, January 2011.
12. On the effects of reflected waves in transient shear wave elastography. Deffieux T, Gennisson JL, Bercoff J, Tanter M. IEEE Trans Ultrason Ferroelectr Freq Control. 2011 Oct;58(10):2032-5.
13. Assessment of viscous and elastic properties of sub-wavelength layered soft tissues using shear wave spectroscopy: theoretical framework and in vitro

experimental validation. Nguyen TM, Couade M, Bercoff J, Tanter M. IEEE Trans Ultrason Ferroelectr Freq Control. 2011 Nov;58(11):2305-15.

Book chapter

1. Ultrafast Ultrasound Imaging, Bercoff J., Ultrasound Imaging - Medical Applications, InTech, edited by Igor V. Minin and Oleg V. Minin, September 2011

International congress presentations

1. A new paradigm in ultrasound imaging. Souquet J. BMUS 2008.
2. Supersonic Shear Wave Elasticity Imaging. Fink M. et al. IEEE 2008
3. Optimal design of ultrasonic beam profiles for acoustic radiation force based elastography. Bercoff. J. et al. IEEE 2008.
4. ShearWave™ Elastography: a new ultrasound imaging mode for assessing quantitatively soft tissue elasticity. Bercoff J. et al. IEEE 2008.
5. Optimal design of ultrasonic beam profiles for acoustic radiation force based elastography. Bercoff J. et al. IEEE 2008.
6. Ultrafast Ultrasound Imaging. Bercoff J. et al. JSUM 2011.
7. Full 3D Elasticity Reconstruction Using Supersonic Shear Imaging. Gennisson JL. et al. IEEE 2008.

II- Clinical

a- Breast

Peer reviewed articles in international journals.

1. In Vivo Breast Tumor Detection using Transient Elastography. Bercoff. J. et al. Ultrasound in Med. & Biol., Vol. 29, No. 10, pp. 1387–1396, 2003.
2. Quantitative Assessment of Breast Lesion Viscoelasticity: Initial Clinical Results Using Supersonic Shear Imaging. Tanter M. et al. Ultrasound in Med. & Biol., Vol. 34, No. 9, pp. 1373–1386, 2008.
3. Breast Lesions: Quantitative Elastography with Supersonic Shear Imaging—Preliminary Results. Athanasiou A. et al. Radiology. 2010 Jul;256(1):297-303.
4. Quantitative shear wave ultrasound elastography: initial experience in solid breast masses. Evans A. et al. Breast Cancer Res. 2010;12(6):R104.
5. Clinical application of shear wave elastography (SWE) in the diagnosis of benign and malignant breast diseases. Chang JM. Et al. Breast Cancer Res Treat. 2011 Aug;129(1):89-97.
6. Changes in ultrasound shear wave elastography properties of normal breast during menstrual cycle. Rzymiski P. et al. Clin Exp Obstet Gynecol. 2011;38(2):137-42.
7. Pattern classification of ShearWave™ Elastography images for differential diagnosis between benign and malignant solid breast masses. Tozaki M, Fukuma E. Acta Radiol. 2011 Dec 1;52(10):1069-75.

8. Use of shear wave sonoelastography in capsular contracture before and after secondary surgery: report of two cases. Rzymiski P, Kubasik M, Opala T. J Plast Reconstr Aesthet Surg. 2011 Dec;64(12):e309-12.
9. Shear wave elastography for breast masses is highly reproducible. Cosgrove DO, Berg WA, Doré CJ, Skyba DM, Henry JP, Gay J, Cohen-Bacrie C; the BE1 Study Group. Eur Radiol. 2011 Dec 31.
10. Shear-wave Elastography Improves the Specificity of Breast US: The BE1 Multinational Study of 939 Masses. Berg WA, Cosgrove DO, Doré CJ, Schäfer FKW, Svensson WE, Hooley RJ, Ohlinger R, Mendelson EB, Balu-Maestro C, Locatelli M, Tourasse C, Cavanaugh BC, Juhan V, Stavros AT, Tardivon A, Gay J, Henry JP, Cohen-Bacrie C, and the BE1 Investigators. Radiology 2012;262:435-449

International congress presentations

1. Initial experience with a new ultrasound imaging technique to measure tissue viscoelasticity. Souquet J. et al. Breast Cancer Research July 2008 Vol 10 Suppl 3 Symposium Mammographicum 2008, EBCC6 2008.
2. ShearWave™ Elastography: a new ultrasound imaging mode for assessing quantitatively soft tissue elasticity. Bercoff J. et al. IBMC 2009.
3. Supersonic shear wave elasticity imaging. Fink M. et al. IEEE 2008.
4. In vitro & in vivo Assessment of ShearWave™ Elastography (SWE) Technical Performances. Bercoff J. RSNA 2009.
5. Preliminary assessment of ShearWave™ Elastography features in predicting breast lesion malignancy. Cosgrove D. et al. ECR 2010, ITEC 2010, RCRBG 2010.
6. Elasticity patterns of solid breast lesions with transient shear wave elastography. Lazarou S. ECR 2010.
7. Breast fat: ShearWave™ elasticity measurements. Cosgrove D. et al. ITEC 2010.
8. Shear Wave Elastography Patterns of Common Benign and Malignant Breast Lesions With Histopathologic Correlation. Mendelson E. et al. RSNA 2010.
9. ShearWave Elastography improves the specificity of the BIRADS classification of breast masses by ultrasound: results on 1000 cases in the Breast Elastography (BE1) investigators multicenter study. Cosgorve D. et al. RSNA 2010.
10. Quantitative Shear Wave Ultrasound Elastography of Solid Breast Masses. Evans A. et al. RSNA 2010.
11. Evaluation of 3D shearwave™ elastography and its benefits for the characterization of breast lesions. Amy D. ECR 2011.
12. Clinical benefits evaluation of shear wave elastography in ultrasound examination of breast lesions. Balu-Maestro C. et al. ECR 2011.
13. Improvement of ultrasound breast lesions diagnosis with ShearWave™ Elastography. Souquet J et al. JSUM 2011.
14. Shear Wave Elastography Patterns of Common Benign and Malignant Breast Lesions with Histopathologic Correlation. Mendelson E. et al. WFUMB 2011.
15. Shear-wave Elastographic Values of Benign and Malignant Breast Lesions and Surrounding Tissue. Ivanac G. et al. WFUMB 2011.
16. Use of shear wave sonoelastography in capsular contracture before and after secondary surgery - Report of two cases. Rzymiski P. J Plast Reconstr Aesthet Surg. 2011 Jun 24.

17. Influence of sex hormones in women on breast elasticity measured by shear wave sonoelastography - a cross-sectional study. Rzymyski P. et al. Gynecol Endocrinol. 2011 May 26.
18. Elastographie shear wave en sénologie : sémiologie et intérêt pour le radiologue. Chamming's F, Dang-Tran K, Fournier L, Lefrere-Belda MA, Genisson JL, Tanter M, Frija G. JFR 2011
19. L'élastographie par onde de cisaillement dans la prise en charge diagnostique des lésions mammaires. Cornu J, Tillaux M, Marie B, Brenac F, Bouté V, Notari AC, Lacroix J. JFR 2011
20. Elastographie ShearWave dans les lésions du sein : résultats italiens extraits de l'étude multicentrique. Locatelli M, Sironi D. JFR 2011
21. Increasing Quantitative Maximum Stiffness by Shearwave Elastography (SWE) Predicts Increasingly Severe Histopathology of Breast Masses. Berg WA, Mendelson EB, Cosgrove DO, Doré CJ, Gay J, Henry JP, Cohen-Bacrie C. RSNA 2011.
22. Specificity Is Improved When ShearWave Elastography (SWE) Is Added to BI-RADS® for Breast Ultrasound: Prospective Multicenter International Validation in the BE1 Study. Berg WA, Cosgrove DO, Dore CJ, Schaefer FKW, Svensson WE, Gay J, Henry JP, Cohen-Bacrie C. RSNA 2011.
23. Diagnostic Performance of ShearWave Elastography (SWE) Added to BI-RADS®: US for Masses ≤10mm. Cosgrove DO, Berg WA, Dore CJ, Gay J, Stavros AT, Mendelson EB, Schaefer FKW, Svensson WE. RSNA 2011.
24. Soft Breast Cancers: Patterns and Pitfalls in ShearWave™ Elastography (SWE) in the BE1 International Multicenter Trial. Mendelson EB, Berg WA, Feldman M, Cosgrove DO, Gay J, Cohen-Bacrie C. RSNA 2011
25. The Principles of Elastography and Application in the Analysis of Breast Lesions. Rolén M, Hooley R, Geisel J, Butler R, Philpotts L, Scoutt L. RSNA 2011.

b- Thyroid & Neck

Peer reviewed articles in international journals.

1. Shear Wave Elastography: A New Ultrasound Imaging Mode for the Differential Diagnosis of Benign and Malignant Thyroid Nodules. Sebag F. et al. J Clin Endocrinol Metab. 2010 Dec;95(12):5281-8.
2. Shear wave elastography in the diagnosis of thyroid nodules: feasibility in the case of coexistent chronic autoimmune Hashimoto's thyroiditis. Magri F, Chytiris S, Capelli V, Alessi S, Nalon E, Rotondi M, Cassibba S, Calliada F, Chiovato L. Clin Endocrinol (Oxf). 2012 Jan;76(1):137-41.
3. Shear Wave and Strain Elastography in Ultrasound Diagnosis of Thyroid Cancer. Slapa R. et al. J Ultrasound Med 30:S1-S120, April 2011.
4. Shear wave elastography of focal salivary gland lesions: preliminary experience in a routine head and neck US clinic. Bhatia KS, Cho CC, Tong CS, Lee YY, Yuen EH, Ahuja AT. Eur Radiol. 2011 Dec 27.
5. Shear wave elasticity imaging of cervical lymph nodes. Bhatia KS, Cho CC, Tong CS, Yuen EH, Ahuja AT. Ultrasound Med Biol. 2012 Feb;38(2):195-201.

International congress presentations

1. Correlations between shearwave elastography of thyroid nodules and cytological data: study about 157 patients. Monpeyssen H. et al. ECR 2011, WFUMB 2011.

2. Intérêt de l'élastographie quantitative « ShearWave » pour la prise en charge des nodules thyroïdiens. Garelli M, Felix L, Moreau-Gaudry A, Chipon E, Chabre O, Chaffanjon P, Bricault I. JFR 2011

c- Liver

Peer reviewed articles in international journals.

1. Quantitative Viscoelasticity Mapping of Human Liver Using Supersonic Shear Imaging: Preliminary In Vivo Feasibility Study. Muller M. et al. Ultrasound in Med. & Biol., Vol. 35, No. 2, pp. 219–229, 2009.
2. Noninvasive in vivo liver fibrosis evaluation using supersonic shear imaging: a clinical study on 113 hepatitis C virus patients. Bavu E. et al. Ultrasound Med Biol. 2011 Sep;37(9):1361-73.

International congress presentations

1. A New Potent Morphological Non-Invasive Predictor of Liver Fibrosis Staging by Supersonic Shear Imaging: Clinical Study. Bavu E. et al. AASLD 2010.
2. Assessment of response following Radiofrequency Ablation (RFA) using ShearWave™ Elastography (SWE). Leen E. et al. RSNA 2010.
3. Application of ShearWave™ Elastography (SWE) in assessing the effect of systemic treatment of liver tumours. Leen E. et al. RSNA 2010.
4. Quantitative Assessment of The Elasticity Values Of Liver With Shearwave Ultrasonographic Elastography. Arda K. et al. ECR 2011.
5. Intraobserver and Interobserver Variability in the Estimation of Liver Fibrosis with Shear Wave Elastography in Chronic Liver Disease: A Proposition for standardization Through a Modified Protocol. Zoumpoulis P. et al. J Ultrasound Med 30:S1–S120, April 2011.
6. Evaluation of the elasticity of hepatic lesions using 2D Shear Wave Elastography. Guibal A. et al. ESGAR 2011.
7. Measurement of liver stiffness by shear wave elastography (SWE): comparison of median values between 5-times and 10-times measurements. Jeong WK. et al. ESGAR 2011.
8. Measurement of liver stiffness by shear wave elastography (SWE): Various diffuse liver diseases. Jeong WK. et al. ESGAR 2011.
9. Shear wave sonoelastography: a new method to differentiate intermediate stages of liver fibrosis. Dhyani M, Samir A. SRU 2011.
10. Use of Aixplorer® for Detection of Liver Fibrosis or Cirrhosis in Patients with Hepatitis C. Karlas T, Tröltzsch M, Wiegand J, Keim V. WFUMB 2011.
11. ShearWave Elastography for the Evaluation of Diffuse Liver Disease: Determining Normal and Pathological Values in kPa. Zoumpoulis P. et al. WFUMB 2011.
12. Technical and Software Adjustments for a Reliable ShearWave Elastography Estimation of Fibrosis in Chronic Liver Disease. Zoumpoulis P. et al. WFUMB 2011.
13. Performance of Real-Time Elastography and Transient Elastography in the Assessment of Liver Fibrosis in Chronic Hepatitis. Ferraioli G, Tinelli C, Dal Bello B, Calderon W, Lissandrin R, Filice C. The Liver Meeting (AASLD) 2011.

14. Accuracy of Real-time Shear-Wave Elastography in the Assessment of Liver Fibrosis. Ferraioli G, Tinelli C, Dal Bello B, Lissandrin R, Michelone G, Filice C. RSNA 2011.
15. Evaluation Focal Hepatic Lesions Elasticity Using 2D Shear-Wave Elastography. Guibal A, Bruce M, Leford T, Pilleul F. RSNA 2011.

d- Abdomen

Peer reviewed articles in international journals.

1. Quantitative assessment of normal soft-tissue elasticity using shear-wave ultrasound elastography. Arda K, Ciledag N, Aktas E, Aribas BK, Köse K. AJR Am J Roentgenol. 2011 Sep;197(3):532-6.

International congress presentations

1. Shear wave elastography of adrenal masses. Slapa R. et al. ECR 2011.
2. Shear Wave Elastography During Sonography of Adrenal and Liver Masses: Feasibility Study. Slapa R. et al. J Ultrasound Med 30:S1–S120, April 2011.
3. Shear Wave Elastography of Abdominal and Retroperitoneal Masses and Inflammatory Processes: a Feasibility Study. Slapa R. et al. WFUMB 2011.
4. Detection of intrarenal microstructural changes with supersonic shear wave elastography in rats. Derieppe M et al. Eur Radiol. 2011 Aug 16.

e- Prostate

International congress presentations

1. Trans-rectal quantitative Shear Wave Elastography : application to prostate cancer - A feasibility study. Correas JM. Et al. ECR 2011.
2. Transrectal Shear Wave Elastography of the Prostate: Initial Results and Potential Implications. Barr R. et al. ITEC 2011.
3. Quantitative Shear Wave Elastography for Prostate Lesion Evaluation. Correas JM. Et al. WFUMB 2011.
4. Role of Shear Wave Elastography (SWE) in Detection and Characterization of Focal Lesions of the Prostate. Theotokas I. et al. WFUMB 2011.
5. Transrectal Ultrasound Quantitative Shear Wave Elastography : Application to Prostate Nodule Characterization – A Feasibility Study. Correas JM. et al. WFUMB 2011.
6. Elastographie ShearWave pour le diagnostic du cancer de la prostate : étude préliminaire. Corr as JM, Khairoune A, Tissier AM, Vassiliu V, Eiss D, M jean A, H l non O. JFR 2011
7. Shear Wave Elastography of the Prostate: Initial Results and Pathology Correlation. Barr RG, Memo R, Schaub CR. RSNA 2011.
8. Transrectal Ultrasound Quantitative Shear Wave Elastography : Application to Prostate Nodule Characterization – A Feasibility Study. Correas JM, Khairoune A, Tissier A, Vassiliu V, M jean A, H l non O. RSNA 2011

f- Muscles-Tendons

Peer reviewed articles in international journals.

1. Viscoelastic and Anisotropic Mechanical Properties of In Vivo Muscle Tissue Assessed by Supersonic Shear Imaging. Gennisson JL. et al. *Ultrasound in Med. & Biol.*, Vol. 36, No. 5, pp. 789–801, 2010
2. Muscle shear elastic modulus measured using supersonic shear imaging is highly related to muscle activity level. Nordez A. et al. *J Appl Physiol* 108: 1389–1394, 2010.
3. Real-Time Visualization of Muscle Stiffness Distribution with Ultrasound Shear Wave Imaging during Muscle Contraction. Shinohara M. et al. *Muscle Nerve* 42: 438–441, 2010
4. Ultrasound Imaging and Elastography of the Rotator Cuff Muscles: Elasticity Measurements of the Supraspinatus and Infraspinatus Muscles using Shear Wave Elastography. Plagou A. et al. *ECR 2011, J Ultrasound Med* 30:S1–S120, April 2011
5. Élastographie transitoire du tendon calcanéen : résultats préliminaires et perspectives. Aubry S, Risson JR, Barbier-Brion B, Tatu L, Vidal C, Kastler B. *Journal de radiologie* (2011) 92, 421–427

g- Cardio-vascular

Peer reviewed articles in international journals.

1. Quantitative assessment of arterial wall biomechanical properties using shear wave imaging. Couade M, Pernot M, Prada C, Messas E, Emmerich J, Bruneval P, Criton A, Fink M, Tanter M. *Ultrasound Med Biol.* 2010 Oct;36(10):1662-76.
2. In vivo quantitative mapping of myocardial stiffening and transmural anisotropy during the cardiac cycle. Couade M, Pernot M, Messas E, Bel A, Ba M, Hagege A, Fink M, Tanter M. *IEEE Trans Med Imaging.* 2011 Feb;30(2):295-305.
3. Real-time assessment of myocardial contractility using shear wave imaging. Pernot M, Couade M, Mateo P, Crozatier B, Fischmeister R, Tanter M, *Journal of the american college of cardiology*, June 28, 2011; 58: 65 - 72.
4. Mapping Myocardial Fiber Orientation using Echocardiography-Based Shear Wave Imaging, W-L Lee, M Pernot, M Couade, E Messas, A Hagege, M Fink, A Bel, P Bruneval, M Tanter, *IEEE Trans Med Imaging.* 2011 Oct 19.

International congress presentations

1. Dynamic and quantitative assessment of myocardial stiffness using shear wave imaging M Pernot, M Couade, P Mateo, B Crozatier, R Fischmeister, M Tanter *Proceedings of the IEEE International Symposium on Biomedical Imaging 2010*, pp 976 – 979
2. Mapping Myocardial Elasticity Changes after RF-Ablation Using Supersonic Shear Imaging. M Pernot, E Macé, R Dubois, M Couade, M Fink, M Tanter *Proceedings of IEEE Computers in Cardiology*, 2009, Vol 36
3. Quantitative Imaging of Myocardium elasticity using Supersonic Shear Imaging M Couade, M Pernot, M Tanter, E Messas, A Bel, M Ba, A Hagege, M Fink *Proceedings of the IEEE International Ultrasonic Symposium*, 2009

4. Ultrafast imaging of the heart using Circular Wave Synthetic Imaging using with phased and curvilinear Arrays M Couade, M Pernot, M Tanter, E Messas, A Bel, M Ba, A Hagege, M Fink Proceedings of the IEEE International Ultrasonic Symposium, 2009
5. Non-Invasive Quantitative Imaging of arterial wall elasticity using Supersonic Shear Imaging. M Couade, M Pernot, C Prada, E meass, M Tanter, M Fink IEEE International Ultrasonic Symposium, Beijing, Nov. 2008
6. Evaluation of local arterial stiffness using ultrafast imaging: a comparative study using local arterial pulse wave velocity estimation and shear wave imaging. Mathieu Couade, Christina Flanagan, Wei-Ning Lee, Emmanuel Messas, Mathias Fink, Mathieu Pernot, Mickaël Tanter, Proceedings of the IEEE International Ultrasonic Symposium, San Diego, Oct. 2010
7. Noninvasive Assessment of Myocardial Anisotropy in Vitro using Supersonic Shear Wave Imaging. Wei-Ning Lee, Mathieu Couade, Christina Flanagan, Mathieu Pernot, Mickaël Tanter, Proceedings of the IEEE International Ultrasonic Symposium, San Diego, Oct. 2010
8. Quantification of myocardial elasticity using shear wave imaging M Couade, M Pernot, E Messas, A Bel, A Hagege, M Fink, M Tanter, Euroecho 2009 (Madrid)
9. Non-Invasive quantitative Imaging of arterial wall elasticity using supersonic shear imaging M. Pernot, M. Couade, M. Tanter, J. Emmerich, M. Fink, E Messas European Society of cardiology conference 2009
10. Real time Non-Invasive Quantitative Imaging of arterial wall elasticity using Supersonic Shear Imaging M Couade, M Pernot, M Tanter, M Fink, J Emmerich, E Messas. American Heart Association conference, New Orleans Nov. 2008
11. Real-Time Local Evaluation of Arterial Pulse Wave Velocity Using Ultrafast Echo Imaging. M Couade, M Pernot, M Tanter, M Fink, J Emmerich, E Messas. American college of cardiology, Orlando, Mars 2009
12. Shear wave imaging: concept, current clinical use and potential applications on myocardium. M Pernot, M Couade, M Fink, M Tanter Symposium on Myocardial Velocity and Deformation Imaging, Leuven , Fev. 2010 (invité)
13. Quantitative assessment of myocardial stiffness using shear wave imaging in normal and Hypertrophic isolated rat hearts. Pernot M, Couade M, Mateo P, Crozatier B, Fischmeister R, Tanter M. European society of cardiology conference, Paris, Aug 2011
14. Noninvasive Assessment of Myocardial Fiber Orientation using Echocardiography-Based Shear Wave Imaging, W-L Lee, M Pernot, M Couade, E Messas, A Hagege, M Fink, A Bel, P Bruneval, M Tanter, European society of cardiology conference, Paris, Aug 2011