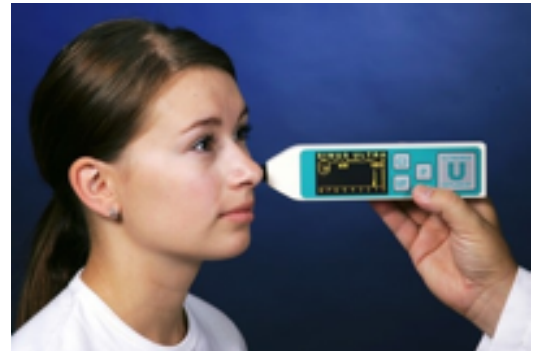


## UTILIZING ULTRASOUND IN THE DIAGNOSIS OF MAXILLARY AND FRONTAL SINUSITIS

### Research White Paper

Finland has been on the leading edge in the development and utilization of sinus ultrasound in the diagnosis of sinusitis: over 50% of possible sinusitis patients in primary healthcare are examined with ultrasound. Sinus ultrasound is suitable for a wide range of end users such as: general practitioners, occupational healthcare, ENT-specialists and allergists.

Sinus ultrasound (3 MHz ultrasound wave) is ideal for detecting maxillary and frontal sinusitis as it propagates well through bone, soft tissues and fluids but not through air. Ultrasound is sent towards the bony back wall of a sinus cavity and the reflected echoes correlate to the depth of the tissue boundaries. A healthy sinus cavity, containing only air, reflects from the anterior wall of the sinus, whilst an infected sinus cavity, filled with fluid, reflects from the posterior wall.



The use of ultrasound in the initial diagnosis of sinusitis, in addition to patient history and other clinical findings, is quicker and more accurate than traditional clinical methods. It significantly reduces unnecessary doctor's appointments, antibiotic treatments as well as expensive or possibly harmful examinations (e.g. X-ray, CT-scan, MRI). Based on research only half of patients with a clinical diagnosis of AMS have sinusitis in ultrasound examination.

Numerous academic and scientific studies, conducted during the past 30 years, support and favor the use of ultrasound when conducting the diagnosis of sinusitis.

#### Research overview:

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| <b>1980</b> | <i>"...In a series of 170 maxillary sinuses of adults and 130 maxillary sinuses of children, statistical evaluation revealed the confidence and sensitivity of ultrasonography to be significantly better than of roentgenography. In a series of 100 frontal sinuses studied with roentgenography and ultrasonography the observed difference was not statistically significant."</i> | <b>Ultrasound in the diagnosis of maxillary and frontal sinusitis</b><br>Revonta, Matti. 1980.<br>Department of Otolaryngology, University Central Hospital, Turku, Finland. 55p.  |
| <b>1981</b> | <i>"...The total agreement between puncture and A-mode ultrasound finding was 94 per cent. The A-scan was positive in 88 per cent of the sinuses with discharge..."</i>  | <b>Diagnosis of subacute maxillary sinusitis in children.</b><br>Revonta M, Suonpaa J. 1981.<br>J Laryngol Otol. 1981 Feb;95(2):133-40.  |
| <b>1982</b> | <i>"...Radiography and OSC-display (=A-mode ultrasound) showed equal capacity of separating "diseased" from "non-diseased" sinuses, 95% and 97%."</i>  | <b>Ultrasonic examination of the paranasal sinuses.</b><br>Jannert M, Andreasson L, Holmer N, Lörinc P. 1982. Malmö, Sweden.<br>Acta Oto-laryngologica Supplement 389, 1982.   |
| <b>1989</b> | <i>"...At the latter date, the concordance between radiography and clinical findings was 71% and between sonography and clinical findings, 93%. The two modalities studied appear to be equally useful in the initial diagnosis of acute maxillary sinusitis. The loss of back-wall echo correlates well with symptomatic improvement of acute sinusitis."</i>                         | <b>The diagnosis and follow-up of pediatric sinusitis: Water's view radiography versus ultrasonography.</b><br>Revonta M, Kuuliala I. 1989.<br>Department of Otolaryngology, Kanta-Häme Central Hospital, Hämeenlinna. Laryngoscope. 1989 Mar;99(3):321-4. |

*"...Accuracy of diagnosis by ultrasonography was 86 per cent. It seems evident, that ultrasonography measures better retained secretion (excluding very small amounts)..."*

**Diagnosis of frontal sinusitis: one-dimensional ultrasonography versus radiography.**

Suonpaa J, Revonta M. 1989. Department of Otorhinolaryngology, Turku University Hospital, Finland. *J Laryngol Otol.* 1989 Aug;103(8):765-7.

**1991** *"...The evaluation was based on a comparison of the preoperative ultrasonographic results with the surgical findings in 27 frontal sinuses. Ultrasonography was found to be a reliable method for the demonstration or exclusion of mucosal swelling and accumulated fluid (sensitivity 92%; specificity 93%)."*

**Ultrasonography as a method of examination of the frontal sinus.**

Otten FW, Engberts GE, Grote JJ. 1991. Department of Otorhinolaryngology and Head and Neck Surgery, Leiden University Hospital, The Netherlands. *Clin Otolaryngol Allied Sci.* 1991 Jun;16(3):285-7.

**2000** *"...The high specificity of ultrasonography indicates that a positive ultrasound finding can be regarded as evidence of maxillary sinusitis... Active use of ultrasonography would substantially decrease the need for radiological imaging of the sinuses and also help reduce unnecessary antibiotic treatment in primary care."*

**Validity of ultrasonography in diagnosis of acute maxillary sinusitis.**

Puhakka T, Heikkinen T, Makela MJ, Alanen A, Kallio T, Korsoff L, Suonpaa J, Ruuskanen O. 2000. Department of Pediatrics, Turku University Hospital, Turku, Finland. *Arch Otolaryngol Head Neck Surg.* 2000 Dec;126(12):1482-6.

*"...We conclude that ultrasonography, which is non-ionizing, can provide an alternative to plain radiography in the initial investigation of maxillary sinusitis."*

**Ultrasonography versus radiography in the diagnosis of maxillary sinusitis..**

Ghatasheh M, Smadi A. Department of Radiology, King Hussein Medical Centre, Amman, Jordan. *East Mediterr Health J.* 2000 Sep-Nov;6(5-6):1083-6

**2003** *"...With practice and training a physician can detect fluid in maxillary sinuses by sinus ultrasound as reliably as by radiographs. A back wall echo in sinus ultrasound examination is a reliable sign of fluid in the sinus. Only half of patients with clinically diagnosed AMS have fluid retention in sinus ultrasound examination."*

**Ultrasound in the management of acute rhinosinusitis patients in primary care**

Varonen, Helena. 2003. Academic dissertation. Medical faculty of the university of Helsinki, Helsinki, Finland. 105p.

*"...The sensitivity of ultrasound compared to radiography was 92% and specificity was 95% when results were calculated per patients as unit of analysis. With practice and teaching primary care physicians can perform sinus ultrasound as accurately as specialists. Symptoms and clinical examination were not reliable in AMS diagnosis. If the criterion for AMS diagnosis were fluid in maxillary sinuses in ultrasound instead of clinical impression, the number of antibiotic prescriptions would be reduced by half in primary care."*

**Acute rhinosinusitis in primary care: a comparison of symptoms, signs, ultrasound, and radiography.**

Varonen H, Savolainen S, Kunnamo I, Heikkinen R, Revonta M. 2003. Department of Otolaryngology, University of Helsinki, Finland. *Rhinology.* 2003 Mar;41(1):37-43.

*"...Only half of patients with a clinical diagnosis of AMS have sinusitis in ultrasound examination. Meaning that half of the patients were prescribed unnecessary antibiotics."*

**Treatment of acute rhinosinusitis diagnosed by clinical criteria or ultrasound in primary care. A placebo-controlled randomised trial.**

Varonen H, Kunnamo I, Savolainen S, Makela M, Revonta M, Ruotsalainen J, Malmberg H. 2003. Department of Otorhinolaryngology, University of Helsinki, Finland. *Scand J Prim Health Care.* 2003 Jun;21(2):121-6.

**2011** *"...Ultrasound helps in ruling out maxillary secretion and, thus, in avoiding overdiagnosis of acute bacterial maxillary rhinosinusitis. Because it is easy to perform and has no adverse effects, ultrasound device should be available in general practitioner's and otolaryngologist's office."*

**Ultrasound device helps in ruling out maxillary sinus fluid in acute rhinosinusitis: how we do it.**

Teppo H, Revonta M. *Clin Otolaryngol* 2011;36(5):491-4.

**2013** *"...If symptoms continue for over 10 days, or severe symptoms continue for over 3 days, or symptoms turn worse in the course of the disease, bacterial sinusitis should be suspected. Diagnosis is based on clinical findings, and can be confirmed with ultrasound examination."*

**Acute sinusitis: Finnish clinical practice guidelines.**

Hytönen M, Nokso-Koivisto J, Huovinen P, Ilkko E, Jousimaa J, Kivistö J, Korppi M, Liira H, Malmivaara A, Numminen J, Pirilä T. Finnish Society of Otorhinolaryngology committee. *Scand J Infect Dis.* 2013.