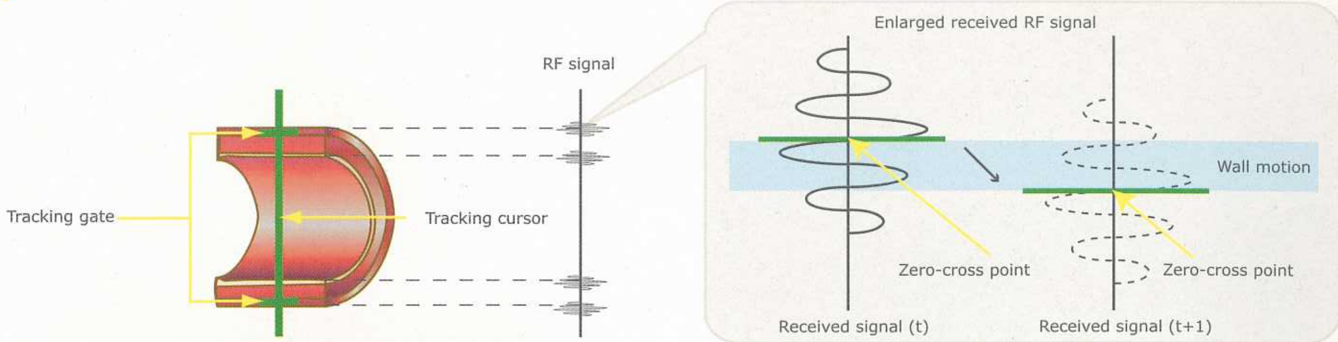
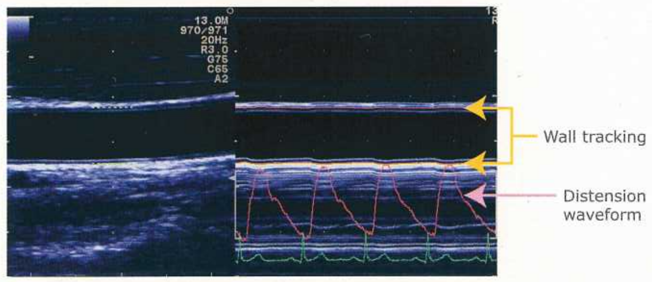
Principle of *e*TRACKING





First the tracking gate is set at a zero-cross point of the RF signal (t). When the vessel wall moves according to the heart beat, the succeeding received RF signal (t+1) also moves in response. At this time, the tracking gate automatically detects the zero-cross point of the succeeding RF signal and moves there. This process is repeated, with the result that the system follows the motion of the vessel walls correctly.

Features of *e*TRACKING

① Only by setting the tracking gate on the B-mode image, the tracking gate automatically follows the motion of the vessel walls caused by the heart beat.
② The vessel diameter is measured accurately as RF signal is used. The 10 MHz probe achieves 0.01 mm accuracy, which is equivalent to about 10 times the accuracy of ordinary B- or M-mode measurement.
③ The distension waveform is displayed in real time.
④ The vessel diameter is measured at a high sampling rate of 1000 times per second to provide an excellent time resolution.
⑤ The flow velocity waveform is also displayed in combination with the color Doppler.
⑥ Multiple parameters are automatically calculated and displayed on the analysis display screen.
⑦ Easier to operate than conventional methods, applicable to routine examination and shortens examination time.
⑧ Non-invasiveness allows for repeated examination.

Features of FMD Analysis Using *e*TRACKING

① Incorporation of FMD analysis software into ultrasound diagnostic system makes it easy to control all processes from data collection to analysis. You can immediately check the analysis result after the necessary data has been collected.
② The vessel diameter is automatically measured by the *e*TRACKING technology to provide high objectivity and reliability never available with manual measurement.
③ Very small vasodilatations are measured with an accuracy of 0.01 mm.
④ Continuous recording of up to 25 minutes allows displaying all the processes of vessel diameter changes from baseline through occlusion and vasodilatation to recovery as a single graph.
⑤ The vessel diameter is measured at a high sampling rate of 1000 times per second. The peak is captured correctly without omission.
⑥ The combination of *e*TRACKING and color Doppler calculates flow velocity and flow volume information to enable quantitative assessment of the level of shear stress.

WI (Wave Intensity) - The new index of cardiovascular circulation dynamics

The heart and the arterial system are constantly interfering with each other through forward traveling waves and reflected waves. WI is calculated based on changes in blood pressure and blood flow speed obtained at an arbitrary point in a circulatory system. Blood pressure change waveform is conventionally measured invasively with a catheter, etc. Aloka has developed a system to calculate WI more simply yet with a high level of accuracy based on the fact that the blood pressure change waveform is similar to the vessel diameter change waveform obtained noninvasively using the *e*TRACKING technology. WI is a new hemodynamic index which is potentially useful for analyzing interference of the cardiovascular system including contraction and dilatation characteristics, influence of reflected waves from peripherals, and an index related to time.

We strive to provide quality products and services for our customers.
We operate with regard for the environment.

We care, Ultrasound@Aloka.

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PRINTED WITH SOY INK
R100
MC2007(59)AK1-5000

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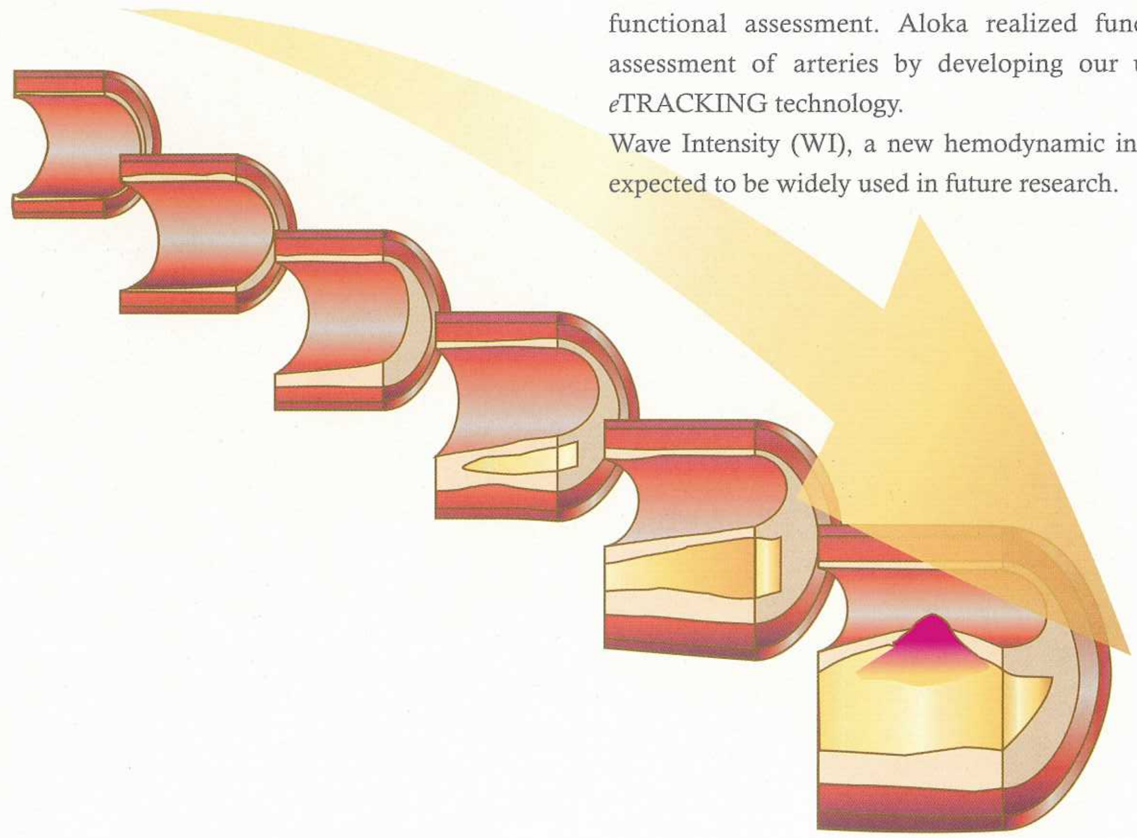
Comprehensive Assessment of Early Atherosclerosis by Ultrasound System

*e*TRACKING: ET/FMD/WI

Cardiovascular diseases can be prevented if atherosclerosis is detected before morphologic changes such as plaque and wall thickening occur on the arterial walls.



Prevention and treatment of lifestyle-related diseases are increasingly important today, and so the role of ultrasound diagnostic system is not only to observe the morphologic changes but also to perform functional assessment. Aloka realized functional assessment of arteries by developing our unique *e*TRACKING technology.
Wave Intensity (WI), a new hemodynamic index, is expected to be widely used in future research.

ALOKA
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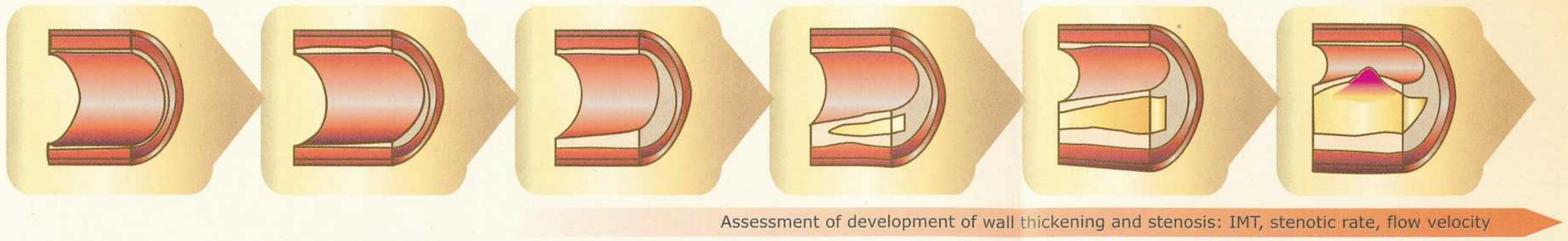
Development of Atherosclerosis and the *e*TRACKING Examination



FMD (Flow Mediated Dilatation)

FMD analysis is generally known as a mean to evaluate endothelial dysfunction noninvasively.

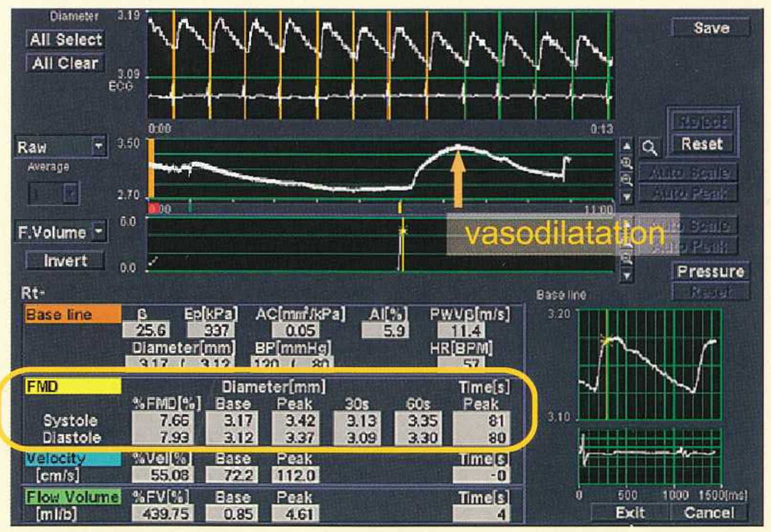
Clinical Usefulness of FMD Examination

①Early detection of atherosclerosis

Endothelial dysfunction is considered to be the first stage of atherosclerosis. Atherosclerosis can be prevented or its development curbed if it is detected at this stage.

②Assessment of the effect of treatment

FMD can be one of the indexes to assess improvement of endothelial function by removing risk factors through exercise, diet and medication.



Systole	Each parameter is calculated from the vessel diameter change graph in which the maximum vessel diameters of individual cardiac cycles are plotted.
Diastole	Each parameter is calculated from the vessel diameter change graph in which the minimum vessel diameters of individual cardiac cycles are plotted.
%FMD	(Peak vessel diameter - Baseline vessel diameter) / baseline vessel diameter
Base	Vessel diameter at baseline
Peak	Vessel diameter at the maximum vasodilatation after releasing the cuff
30s、60s	Vessel diameter at 30 and 60 seconds after releasing the cuff
Time(S) Peak	Time from the cuff release to the maximum vasodilatation

ET/Arterial Stiffness

Multiple parameters necessary for assessing early atherosclerosis are available at a single measurement, enabling more comprehensive and objective assessment.

Clinical Usefulness of ET/Arterial Stiffness Examination

①Early detection of atherosclerosis

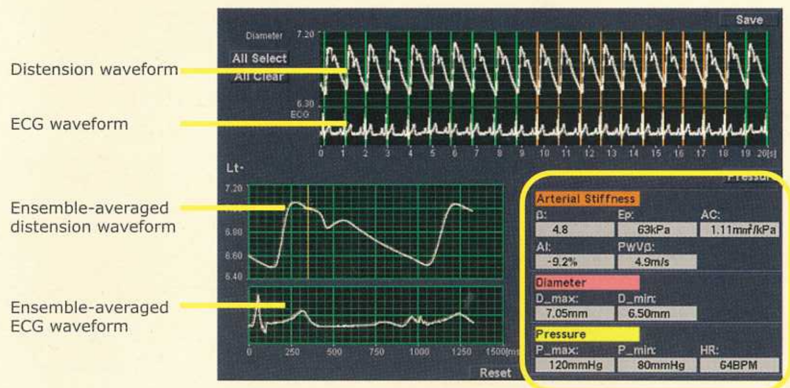
It is possible to quantitatively assess arterial stiffness before onset of organic changes such as thickening of vessel walls and plaque formation.

②Estimation of "blood vessel age" to help prevent atherosclerosis

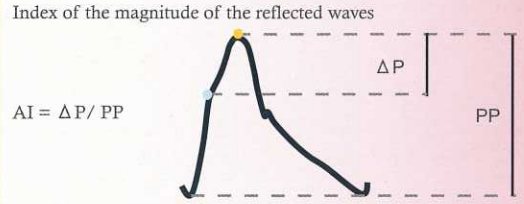
It can be applied to a complete medical checkup of healthy people to estimate their blood vessel age, so that they can be instructed to improve their lifestyle through diet and exercise to prevent atherosclerosis.

③Index for judging the effect of treatment and for follow-up observation

The index can be effective for judging the effect of medication in follow-up observation to see if atherosclerosis has been improved as a result of removing risk factors through improvement of lifestyle.



Select distension waves of several cardiac cycles detected by *e*TRACKING and the system will automatically calculate the ensemble average. Stable results with low dispersion are obtained by averaging. The maximum and minimum vessel diameters read from the ensemble-averaged wave is used to calculate various parameters useful for assessing atherosclerosis.

β (stiffness parameter): Index of stiffness of vessels β = In (Ps / Pd) / [(Ds - Dd) / Dd]	The β value increases with the stiffness of the vessels. This parameter is said to be useful in clinical applications as it is low in blood pressure dependency.
Ep (pressure-strain elastic modulus): Index of elasticity (stiffness) of vessels Ep = (Ps - Pd) / [(Ds - Dd) / Dd]	The Ep value increases with the stiffness of the vessels. This parameter is easily affected by blood pressure.
AC (arterial compliance): Index of arterial compliance AC = π (Ds × Ds - Dd × Dd) / [4 (Ps - Pd)]	The AC value increases with higher arterial compliance.
PWV β (One-Point Pulse Wave Velocity): Index of arterial stiffness, defined by: C m/s = √ (β P / 2 ρ) P: diastolic blood pressure ρ : blood density (1050 kg/m³)	Local pulse wave propagation velocity calculated from stiffness parameter β .
AI (Augmentation Index): Index of the magnitude of the reflected waves 	The pulse wave comprises the forward and reflected waves. The reflected wave increases with the resistance of the peripheral vessels, or with age and development of atherosclerosis. AI is the index of the magnitude of the reflected waves relative to pulse pressure. It increases as the reflected wave become larger and the time for the reflected waves to return becomes shorter. AI examination may assist the early detection of atherosclerosis and prevention of hypertension and cardiac hypertrophy.

Ps: Systolic Blood Pressure ,Pd: Diastolic Blood Pressure ,Ds: Maximum vessel diameter ,Dd: Minimum vessel diameter