SMART Detection

Tachyarrhythmia Therapy

Superior Decision

BIO BIOTRONIK
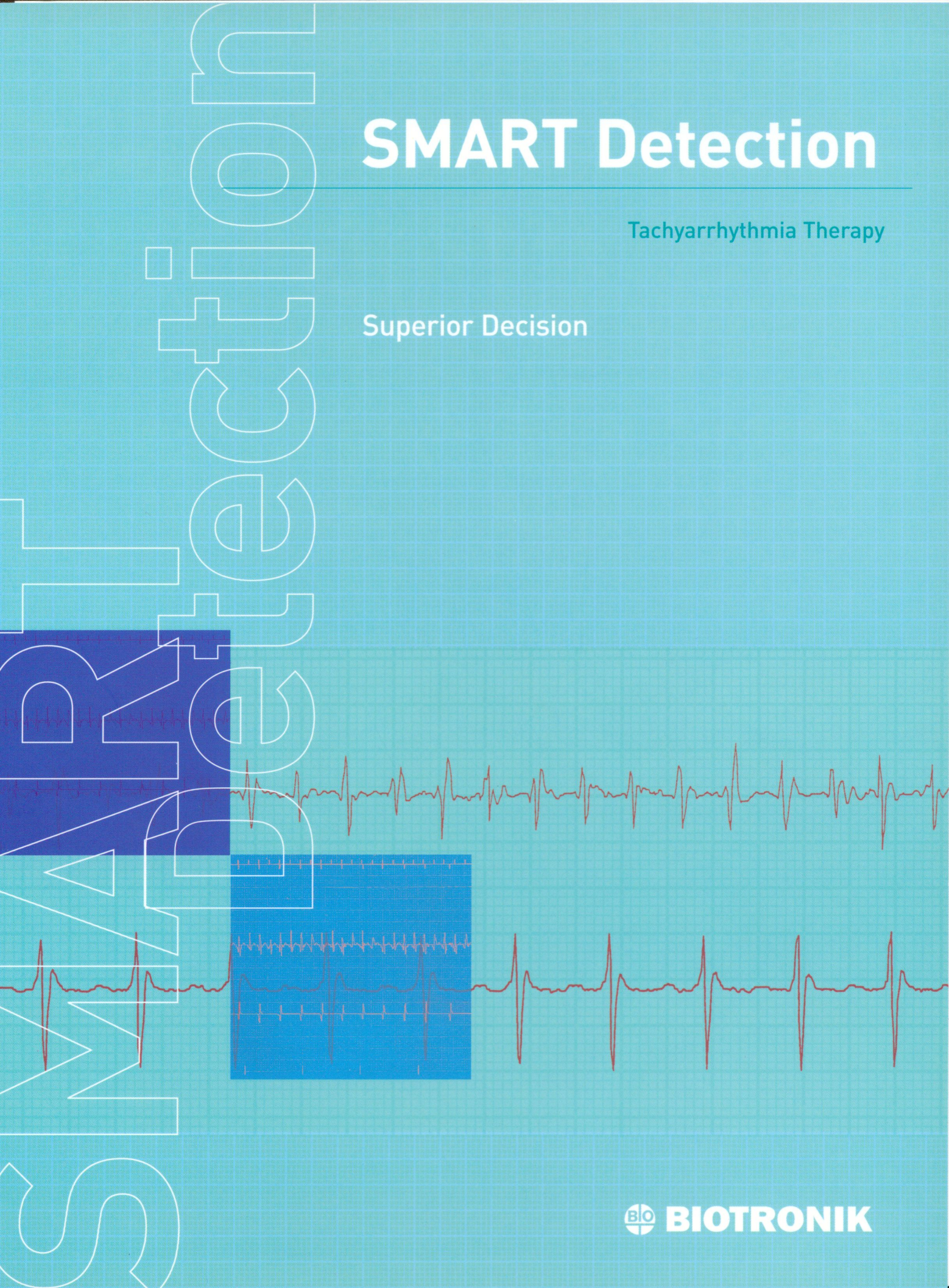
Superior Decision

SMART Detection™ discriminates safely and effectively. Preliminary results from a recent clinical trial show the absolute sensitivity for the detection of ventricular tachycardias (VT) and 93% specificity for the discrimination of supraventricular tachycardias (SVT). SMART Detection™ is implemented in BIOTRONIK's complete line of dual chamber ICDs.
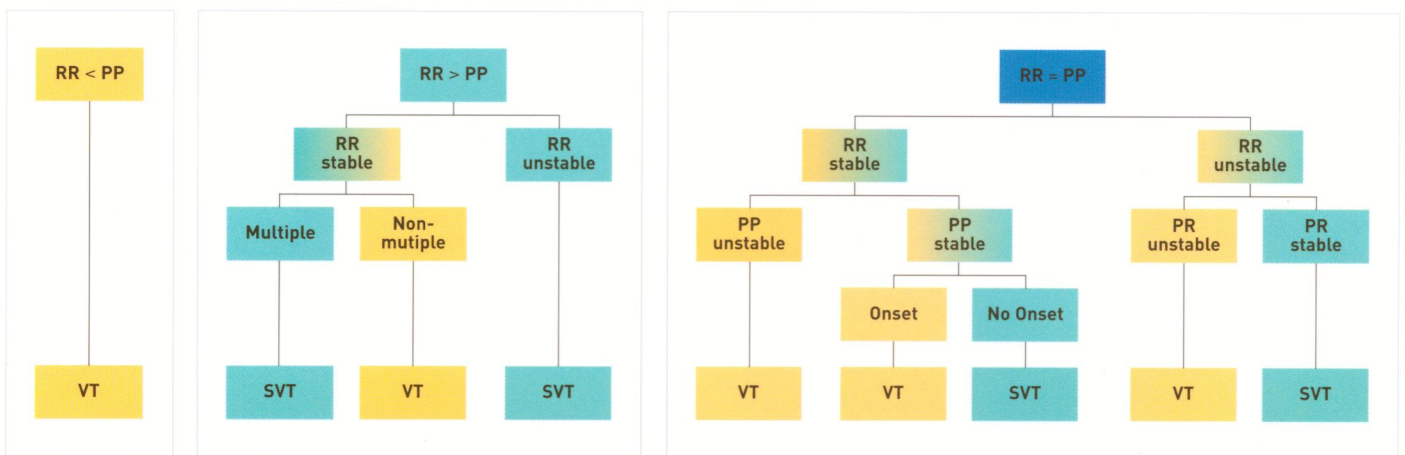
intelligent

- Mean atrial rate
- Stability of atrial rate

- Multiplicity between atrial and ventricular rate
- PR association

- Mean ventricular rate
- Stability of ventricular rate
- Onset of ventricular rate
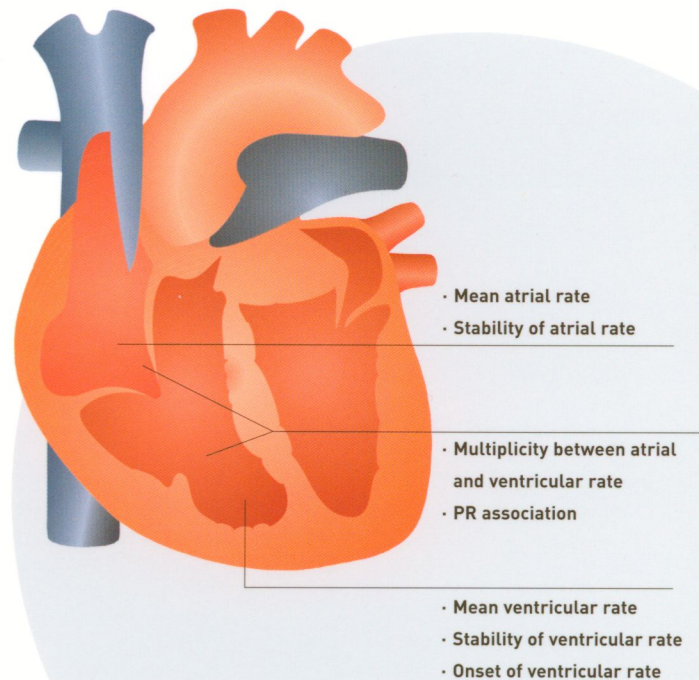
SMART compares the interval lengths and analyses rate stability, multiplicity and PR association.
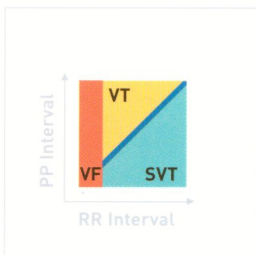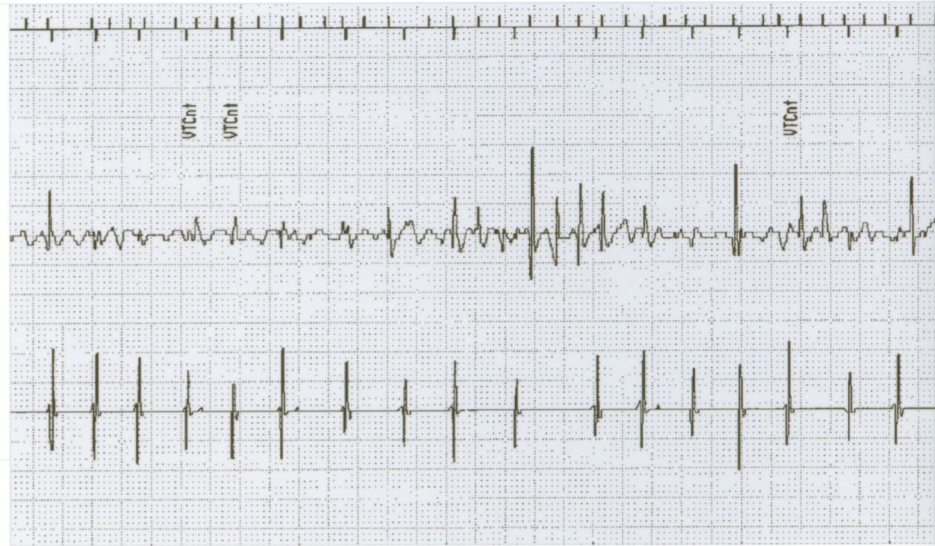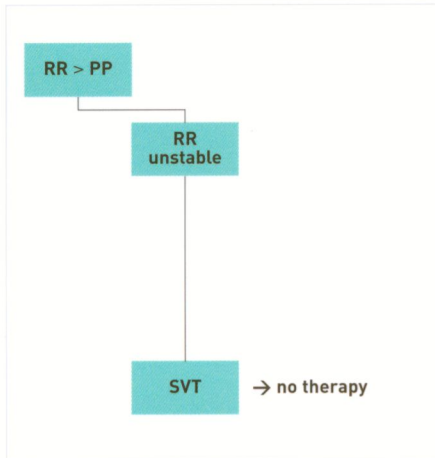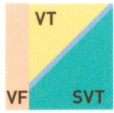
Rhythm Classification

SMART Detection™ analyses the interaction between atrial and ventricular rates. The classification is achieved by performing a test sequence using averaged PP and RR intervals. When a VT is determined, therapy is delivered. The SVT decision inhibits the therapy and is documented by IEGM recording.

PP Interval / RR Interval diagram: VT, VF, SVT

Decision Trees

RR < PP
→ VT

RR > PP
- RR stable
  - Multiple → SVT
  - Non-mutiple → VT
- RR unstable → SVT

RR = PP
- RR stable
  - PP unstable → VT
  - PP stable
    - Onset → VT
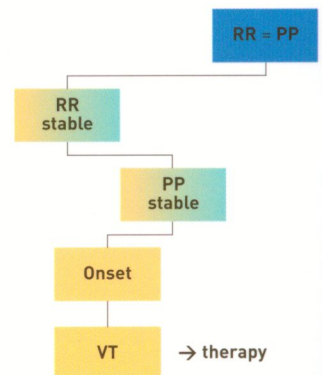   - No Onset → SVT
- RR unstable
  - PR unstable → VT
  - PR stable → SVT

Atrial Fibrillation with Irregular Conduction

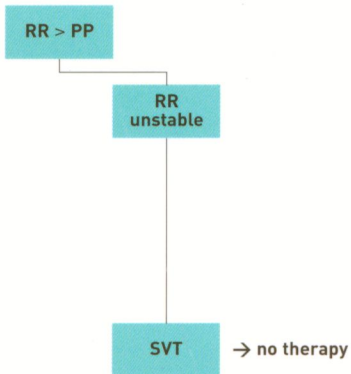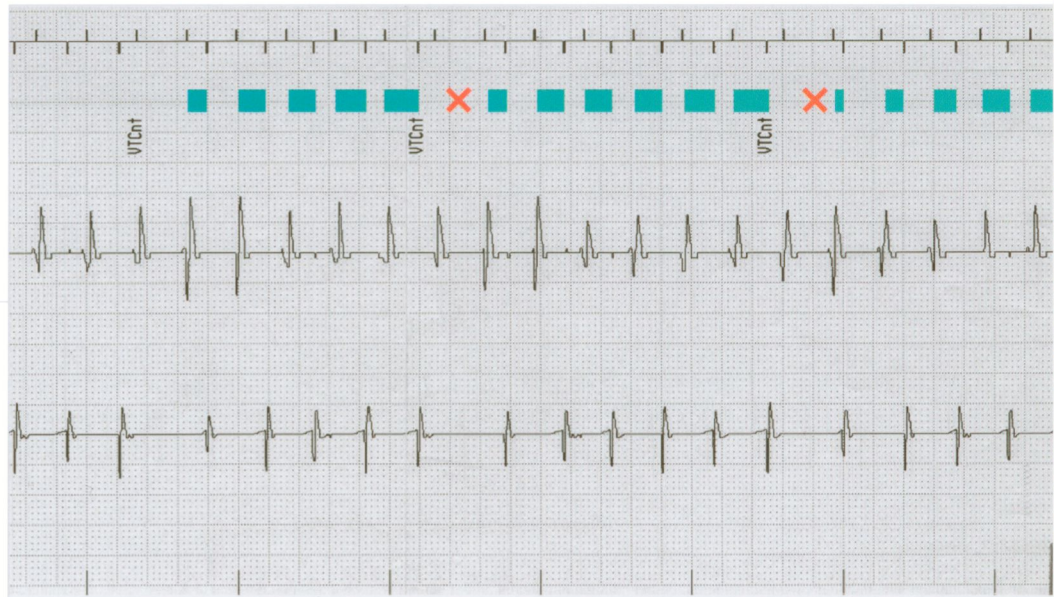| VT	
VF	SVT

RR > PP

RR unstable

SVT → no therapy

VTCnt   VTCnt   VTCnt

adequate

Ventricular Tachycardia with Retrograde Conduction

806		688	352	352	352	350	368	352	368	360	374	368	376	366	376	376	336	296	298	288

664	314	242	360	350	352	352	360	368	352	366	368	368	376	374	376	374	290	298	288	298	2

148
onset   cnt   cnt   cnt   cnt   cnt   cnt   cnt   cnt   cnt   cnt   cnt

VT detected

ATP-delivery

VT	
VF	SVT

RR = PP

RR stable

PP stable

Onset

VT → therapy
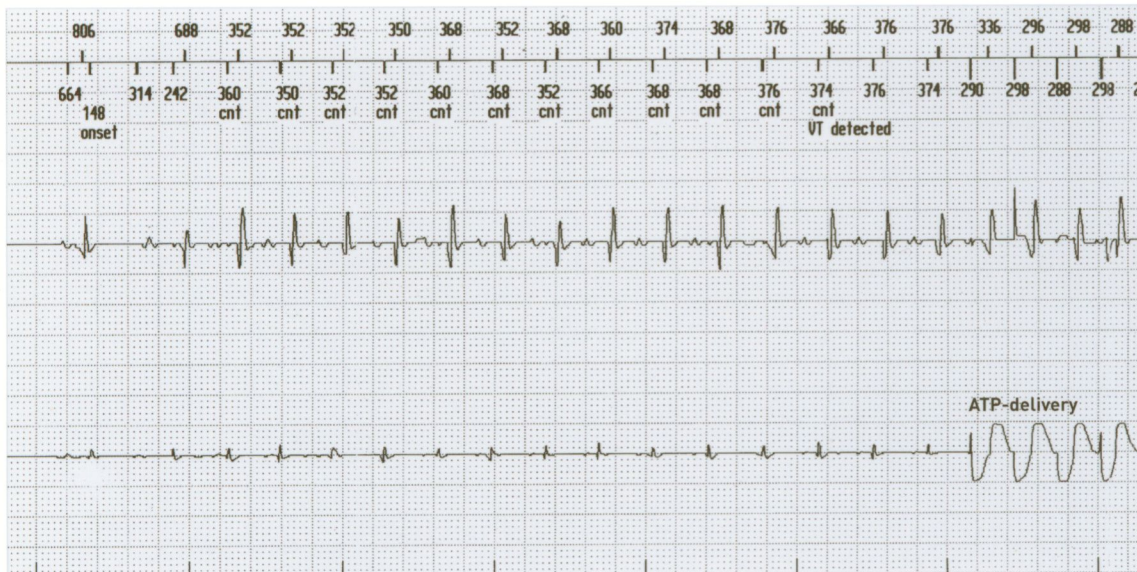
Atrial Tachycardia with Wenckebach Behaviour

VTCnt

VT	
VF	SVT

RR > PP
→ RR unstable
→ SVT → no therapy
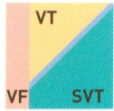
safe

Atrial Flutter with 2:1 Conduction

VT	
VF	SVT

RR > PP
→ RR stable
→ multiple
→ SVT → no therapy
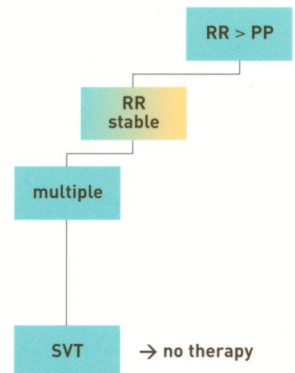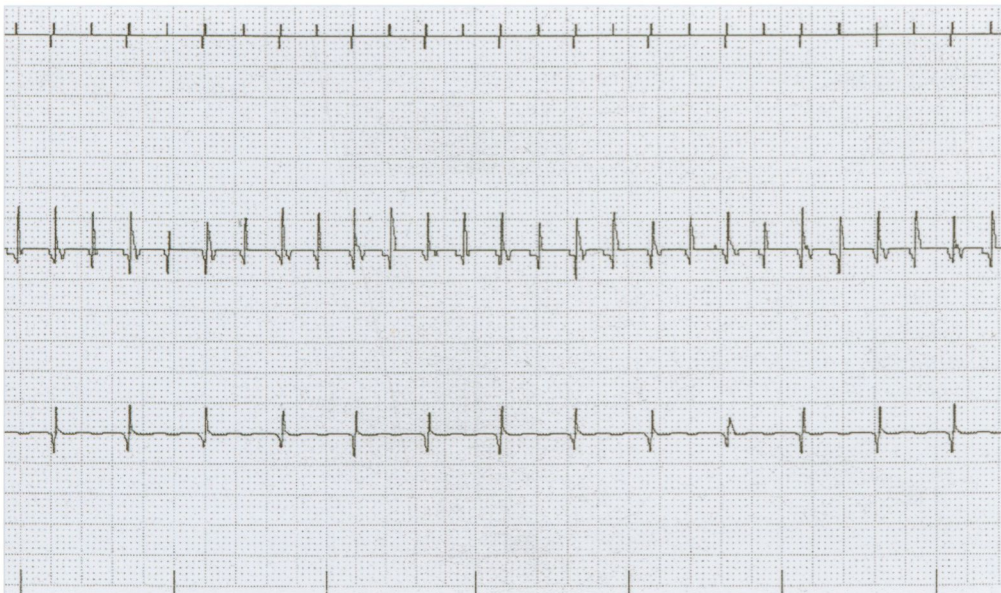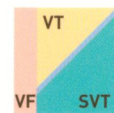
Clinical Study

An international clinical multicenter study was conducted in accordance with FDA regulations. Two of the primary features investigated were sensitivity and specificity of the SMART Detection™ algorithm. The Phylax AV ICD system was implanted in a total of 128 patients between June 1998 and August 2000. Mean age, gender and history of these patients correspond to that of the general ICD patient population.

889 tachycardia episodes in 64 patients have been documented.
SMART was activated for 774 episodes.
SMART was deactivated for patients who suffered primarily from VF episodes.

sensitive

Age:		61 ± 11 years
Sex:	male	112 (87.5%)
	female	16 (12.5%)
LVEF:		31 ± 11%
NYHA*:	class I	20 (14.8%)
	class II	75 (55.5%)
	class III	36 (26.7%)
	class IV	4 (3.0%)

* The sum is more than 128 because some patients were classified to be "between two classes".

100% VT-Sensitivity
93% SVT-Specificity

Results

The results show that the sensitivity of the SMART Detection™ algorithm for appropriately detecting VT was 100%, whereby delivering all appropriate therapy. The specificity of 89.7% was observed when all patient data profiles were considered. Inappropriate therapies can be reduced by optimising the programming (setting of onset delta, deactivation of safety timer). The specificity for optimised programming is 93.3%.

effective

Inappropriate Therapies	
Safety Timer*	17 (2.2%) in 6 patients
No Onset*	11 (1.4%) in 5 patients
Wenckebach	4 (1.4%) in 1 patients
SVT in VF	4 (1.4%) in 1 patients
paroxysmal SVT with 1:1-conduction	4 (1.4%) in 1 patient
other	39 (5.9%) in 9 Patienten

* avoidable with optimised programming

References:

[1] C. Stellbrink, A. M. Sinha, B. Möx, L. Jordaens, B. Merkely, J. Gill, Phylax AV Study Group
First results with the SMART Detection™ algorithm for the
discrimination of supraventricular tachycardias with the implantable
defibrillator Phylax AV.
66th Annual Congress of the German Society for Cardiology, Heart and
Circulation Research, Mannheim, 2000

[2] B. Merkely, J. Witte
Clinical results with the Dual-Chamber Cardioverter Defibrillator
Phylax AV – Efficacy of the SMART Discrimination Algorithm.
Progress in Biomed. Res. 5 (2), 107 – 112, 2000

[3] A. M. Sinha, C. Stellbrink, D. Karla, A. Hahn, P. Hanrath
Discrimination of Ventricular and Supraventricular Tachycardias with a
New Detection Algorithm in a Dual Chamber ICD.
Herzschrittmacher 20 (3), 208 – 214, 2000

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