

**Initial results of treatment with  
Linear Shockwave Therapy (LSWT)  
by Renova in patients with Erectile  
Dysfunction**

A pilot clinical study

# Investigators

- **Dr. Ahmed Hind, MD**

Consultant to Pr.Catanzaro Milano

Pr. S. Leoni Reggio Emilia, Italy

Head of Urology and Andrology Center Red Crescent Hospital (RCH), Ramallah Palestine

- **Dr. Omar Saleh, MD**

RCH, Ramallah Palestine

- **Dr. Yousef Abu Asbeh, MD**

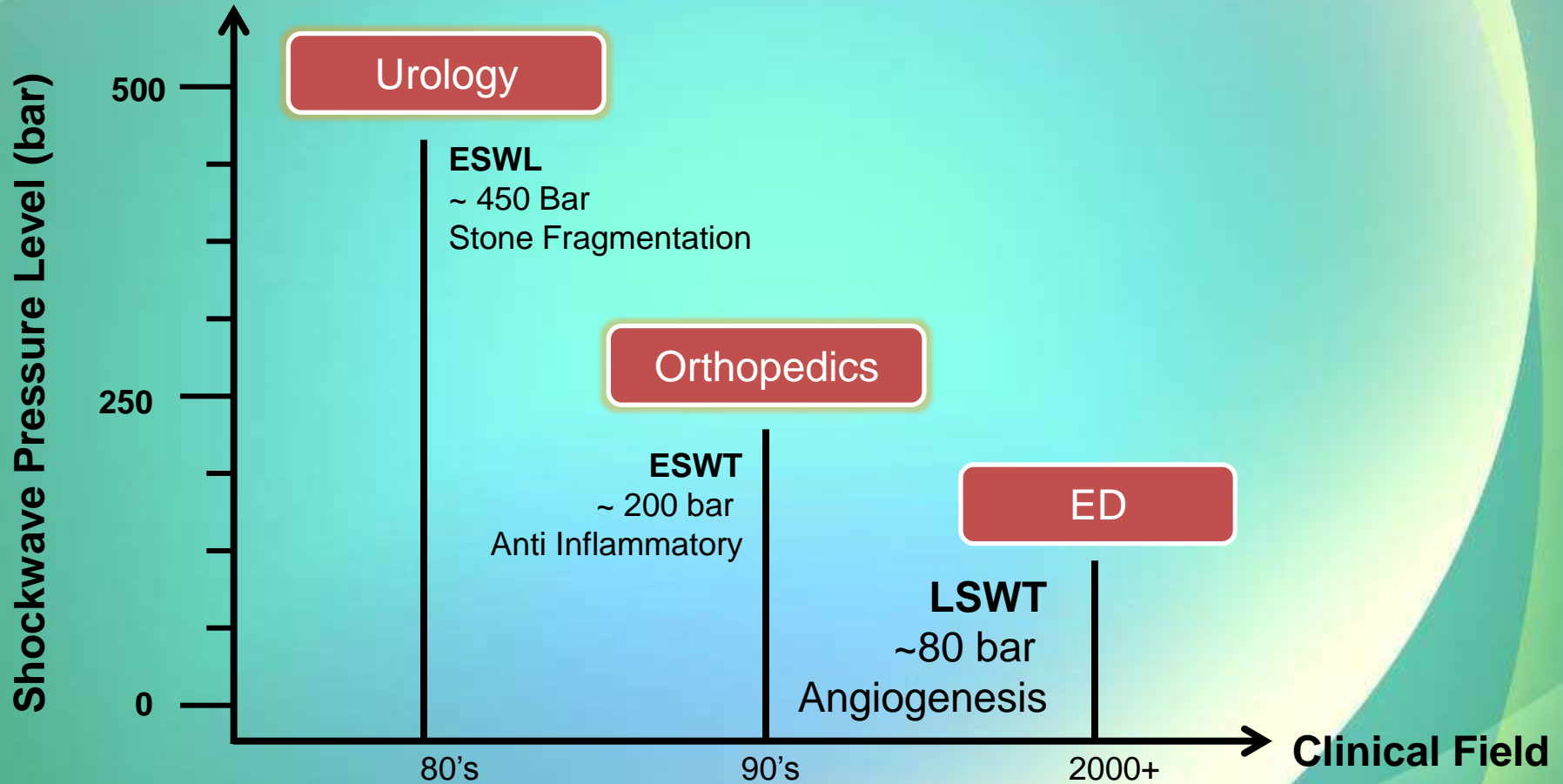
RCH, Ramallah Palestine

# Introduction

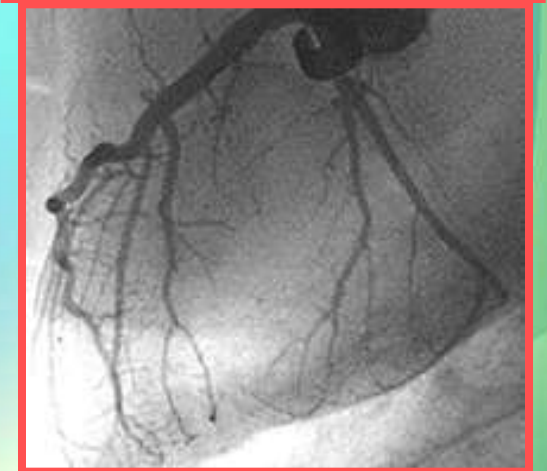
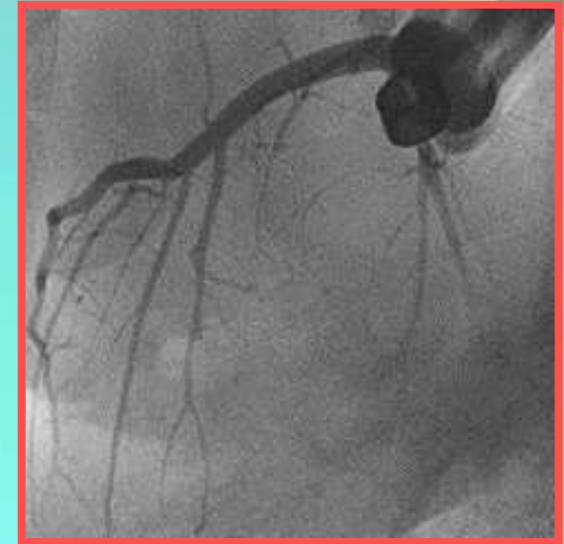
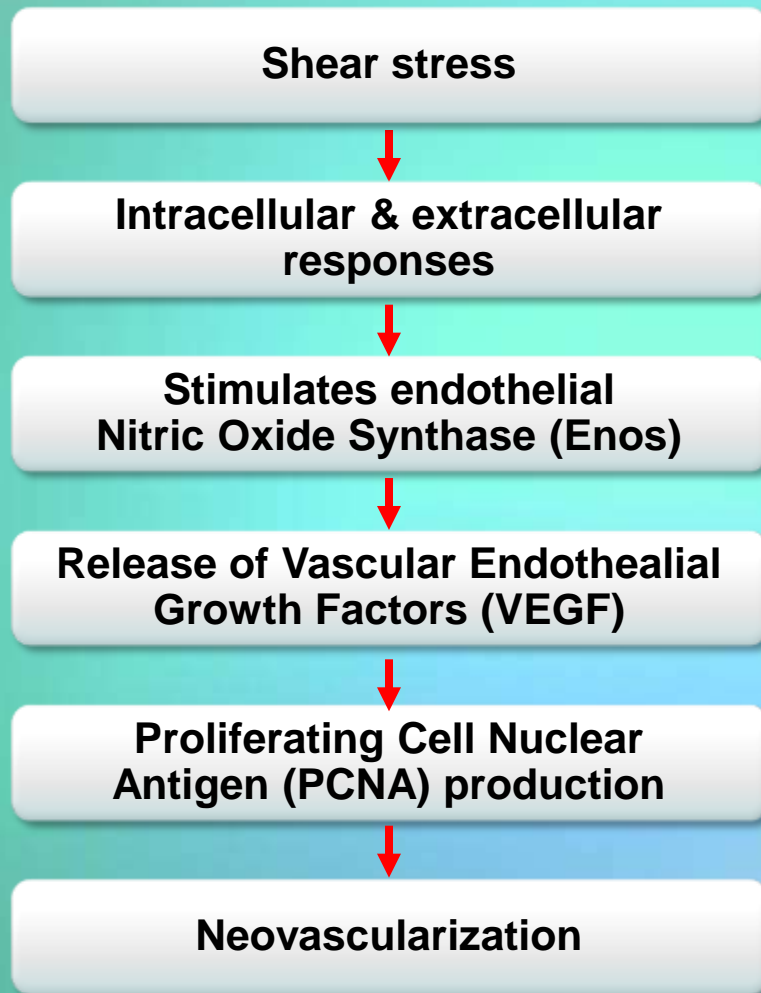
Low intensity shockwave therapy to the penis and crura may help men with the following conditions:

- Mild to moderate erectile dysfunction (ED)
- Both responders and non-responders to conventional phosphodiesterase type 5 inhibitor (PDE-5) treatment

# Shockwave Therapy Applications



# How Low Energy Shockwaves Induce Angiogenesis





# Shockwaves Effect on Angiogenesis

## Clinical Background

- Extracorporeal Cardiac Shockwave Therapy markedly ameliorate ischemia - induced myocardial dysfunction in pigs in Vivo<sup>1</sup>.
- These results suggest that extracorporeal cardiac SW therapy is an effective and noninvasive therapeutic strategy for ischemic heart disease<sup>2</sup>.

<sup>1</sup>Nishida T, Shimokawa H et al. Department of Cardiovascular Surgery, Cardiovascular Medicine, Kyushu University, Fukuoka, Japan

<sup>2</sup>Circulation. 2004;110:30553061

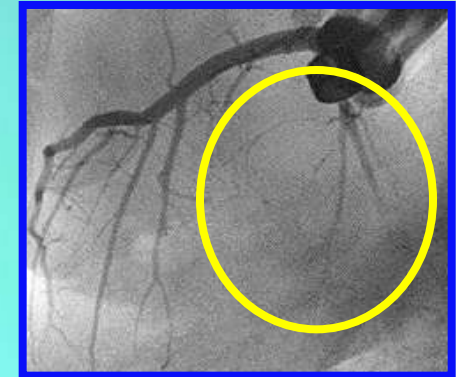
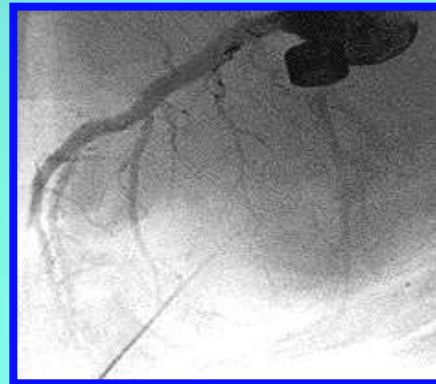
# Enhancement of Coronary Collaterals

## Clinical Background

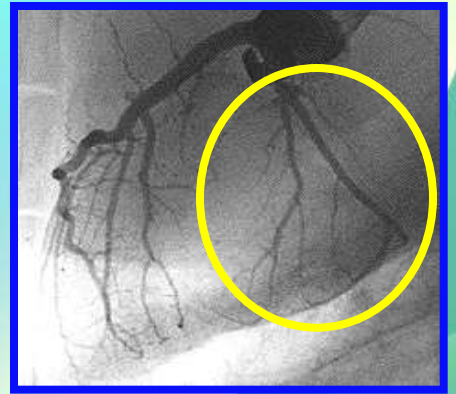
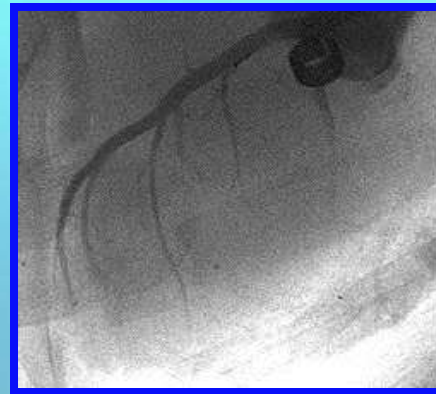
Control Group

SW Group

4 weeks post  
AC implantation



4 weeks post  
treatment



available at [www.sciencedirect.com](http://www.sciencedirect.com)  
journal homepage: [www.europeanurology.com](http://www.europeanurology.com)



Platinum Priority – Sexual Medicine

Editorial by Konstantinos Hatzimouratidis on pp. 249–250 of this issue

## Can Low-Intensity Extracorporeal Shockwave Therapy Improve Erectile Function? A 6-Month Follow-up Pilot Study in Patients with Organic Erectile Dysfunction

Yoram Vardi\*, Boaz Appel, Giris Jacob, Omar Massarwi, Ilan Gruenwald

Neuro-Urology Unit, Rambam Healthcare Campus and the Technion, Haifa, Israel

### Article info

#### Article history:

Accepted April 7, 2010  
Published online ahead of  
print on April 16, 2010

#### Keywords:

Extracorporeal shock wave  
Low intensity  
Erectile dysfunction  
Penis

### Abstract

**Background:** Low-intensity extracorporeal shockwave therapy (LI-ESWT) is currently under investigation regarding its ability to promote neovascularization in different organs.

**Objective:** To evaluate the effect of LI-ESWT on men with erectile dysfunction (ED) who have previously responded to oral phosphodiesterase type 5 inhibitors (PDE5-I).

**Design, setting, and participants:** We screened 20 men with vasculogenic ED who had International Index of Erectile Function ED (IIEF-ED) domain scores between 5–19 (average: 13.5) and abnormal nocturnal penile tumescence (NPT) parameters. Shockwave therapy comprised two treatment sessions per week for 3 wk, which were repeated after a 3-wk no-treatment interval.

**Intervention:** LI-ESWT was applied to the penile shaft and crura at five different sites.  
**Measurements:** Assessment of erectile function was performed at screening and at 1 mo after the end of the two treatment sessions using validated sexual function questionnaires, NPT parameters, and penile and systemic endothelial function testing.

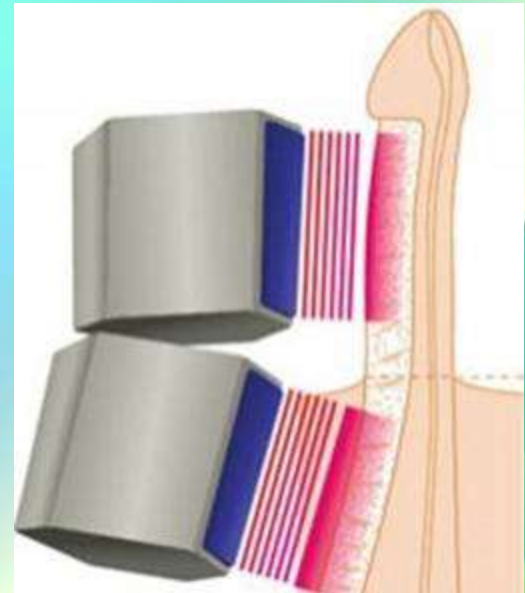


# Study Rationale

- Low Intensity Shockwaves (LISW) are known to produce revascularization and have been used for the past decade in the treatment of Cardiac Chronic Ischemia by various systems.
- LISW utilize very low energy -  $0.09 \text{ mJ/mm}^2$  - equivalent to 10% of the energy used by conventional kidney stone lithotripters in the treatment of urinary tract stones.

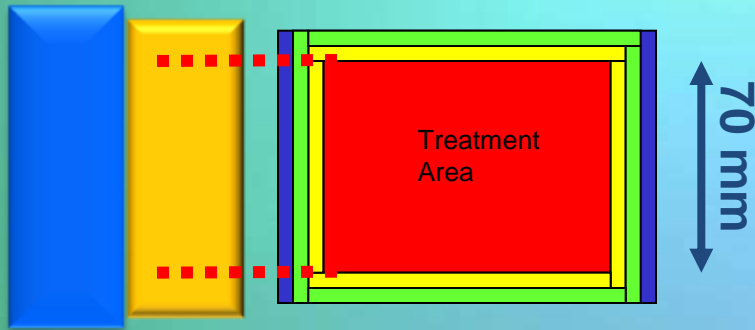
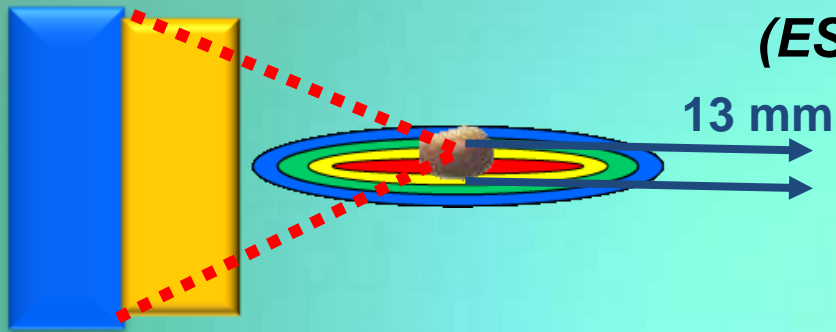
# RENOVA Pilot study

The present study uses a dedicated device (Renova) that utilizes Line Focused Shockwaves, differing from previous models in that it achieves substantially superior organ coverage.

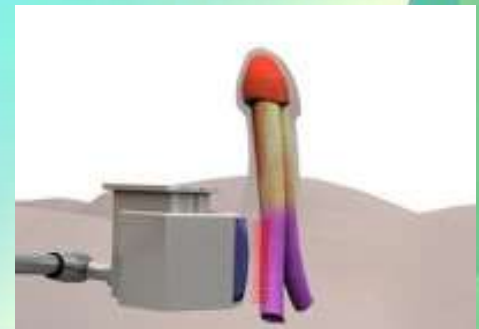


# Focal Zone ESWL vs. ED

*Traditional SW Therapy  
(ESWL/orthopedics)*



*LSWT  
(ED application)*



# Renova Clinical Application

1



Two applications to the crura:

- left crus
- right crus

2



Two applications to the shaft:

- left corpus cavernosum
- right corpus cavernosum



# Study Objectives

- **Primary Efficacy Objective :**

To evaluate the change in the **IIEF- EF** from baseline to 1, 3 and 6 months post treatment. IIEF is widely accepted as the best method to verify ED progress.

- **Secondary Efficacy Objective:**

To study the clinical efficacy of Renova in terms of improvement in sexual activity at 1, 3 and 6 months post treatment, according to the following assessment tools:

- Sexual Encounter Profile (SEP- Questions 2 and 3)
- Global Assessment Question (GAQ)

# Success Criteria

An increase of IIEF-EF score from baseline to the 1<sup>st</sup> follow up according to the severity of the symptoms by the *minimal clinically important differences in the erectile function domain of the International Index of Erectile Function scale.*

IIEF-EF Baseline Score	Success Factor
6-10	improvement of 7 points or more
11-16	improvement of 5 points or more
17-25	improvement of 2 points or more

# Study Population

- **Number of patients: 20**
- **Patients with mild to severe ED symptoms**
- **Both PDE5-i responders and non-responders**

# Design

- This is a pilot clinical study assessing the safety and efficacy of treatments performed by Renova on vasculogenic ED patients.
- Non-responders to PDE5-I will be accepted after challenged with maximum dose of PDE5-I. In case they respond, they will be classified as responders .
- All patients undergo a 3 weeks flush out from PDE5-I before starting treatment.
- After the treatment ends, patients resume PDE5-I consuming.



# Treatments

- **4 weekly** treatment sessions
- **4 treatment areas** (left/right corpus cavernosum, left/right crus)
- **900 shocks** at each area
- **3600 shocks** per session
- Energy Density: **0.09 mJ/mm<sup>2</sup>**
- Frequency: **5 Hz**
- Session time: **15 minutes**

# Follow-up

Follow-up is composed of:

- Questionnaires
- Adverse events report

Timing:

- **1 month** post treatment
- **3 months** post treatment
- **6 months** post treatment

# Eligibility

- **Ages Eligible for Study:** 20 to 80 Years
- **Genders Eligible for Study:** Male (Heterosexual)

# Inclusion Criteria

1. Good general health
2. ED for at least 6 months
3. International Index of Erectile Function -EF (IIEF-EF) of 7-24 while on PDE5-I
4. Positive response to PDE5-I (able to penetrate on demand=Responders)
5. Negative response to PDE5-I (unable to penetrate on demand even with maximum PDE5-I dosage = Non-responders)
6. Stable heterosexual relationship for more than 3 months



# Exclusion Criteria

1. Hormonal, neurological or psychological pathology
2. Past radical prostatectomy or extensive pelvic surgery
3. Recovering from cancer during last 5 years
4. Any unstable medical, psychiatric, spinal cord injury and penile anatomical abnormalities
5. Clinically significant chronic hematological disease
6. Anti-androgens, oral or injectable androgens
7. Radiotherapy in pelvic region

# **Potential Adverse events**

In all known studies where LISW was used for treatment of ED, there have been no reported adverse events.

# Initial Results

# IIEF-EF

## Baseline evaluation data

	Patient Initials	Age (yrs)	IIEF-EF: Q1	IIEF-EF: Q2	IIEF-EF: Q3	IIEF-EF: Q4	IIEF-EF: Q5	IIEF-EF: Q6	IIEF-EF: Total Score
1	MIM	66	2	1	2	1	2	1	9
2	HIS	73	2	2	1	1	1	1	8
3	NMM	72	2	1	1	1	1	2	8
4	JHS	51	3	3	2	2	3	4	17
5	MNS	53	3	2	2	2	3	2	14
6	OIS	53	3	3	3	3	4	3	19
7	MMK	60	2	2	2	2	2	1	11
8	AAD	61	1	1	1	1	1	1	6
9	IHA	51	4	3	3	3	3	3	19
10	AH	38	4	3	3	3	3	3	19
11	SA	33	2	2	2	2	1	3	12
12	AMH	60	3	3	3	3	2	3	17
Average		56	2.58	2.17	2.08	2.00	2.17	2.25	13.25



# IIEF-EF

## 1 Month Follow up data

	Patient Initials	IIEF- EF: Q1	IIEF- EF: Q2	IIEF- EF: Q3	IIEF- EF: Q4	IIEF- EF: Q5	IIEF- EF: Q6	IIEF- EF: Total Score
1	M I M	3	2	3	3	4	3	18
2	H I S	2	2	1	1	1	1	8
3	N M M	2	2	1	1	1	2	8
4	J H S	4	4	4	4	4	4	24
5	M N S	4	4	4	4	5	4	25
6	O I S	4	4	4	4	5	4	25
7	M M K	4	4	4	4	4	4	24
8	A A D	3	3	3	3	4	3	19
9	I H A	5	5	5	4	5	4	28
10	A H	5	5	5	5	4	4	28
11	S A	4	4	3	3	2	4	20
12	A M H	4	4	4	4	4	4	24
<b>Average</b>		<b>3.67</b>	<b>3.58</b>	<b>3.42</b>	<b>3.33</b>	<b>3.58</b>	<b>3.42</b>	<b>20.92</b>

# Improvement in IIEF-EF (%)

		Baseline Evaluation	1 Month Follow-up	
	Patient Initials	IIEF-EF: Total Score	IIEF-EF: Total Score	% improvement
1	M I M	9	18	100.00
2	H I S	8	8	0.00
3	N M M	8	8	0.00
4	J H S	17	24	41.18
5	M N S	14	25	78.57
6	O I S	19	25	31.58
7	M M K	11	24	118.18
8	A A D	6	19	216.67
9	I H A	19	28	47.37
10	A H	19	28	47.37
11	S A	12	20	66.67
12	A M H	17	24	41.18
<b>Average</b>		<b>13.25</b>	<b>20.92</b>	<b>57.86</b>

# Improvement in IIEF-EF

## Success determination

		Baseline	1 Month follow up		
	Patient Initials	IIEF-EF: Total Score	IIEF-EF: Total Score	IIEF Difference	Success
1	M I M	9	18	9	Success
2	H I S	8	8	0	Failure
3	N M M	8	8	0	Failure
4	J H S	17	24	7	Success
5	M N S	14	25	11	Success
6	O I S	19	25	6	Success
7	M M K	11	24	13	Success
8	A A D	6	19	13	Success
9	I H A	19	28	9	Success
10	A H	19	28	9	Success
11	S A	12	20	8	Success
12	A M H	17	24	7	Success
<b>Average</b>		<b>13.25</b>	<b>20.92</b>	<b>7.67</b>	<b>84 %</b>

# Results for Sexual Encounter Profile Questionnaire

- **SEP-Q2:** Over the past 4 weeks ,were you able to insert your penis into your partner's vagina?  
**Yes.....** **No.....**
- **SEP-Q3:** Over the past 4 weeks, did your erection last long enough for you to have successful intercourse?  
**Yes.....** **No.....**





# Results for Global Assessment Questions (GAQ)

**GAQ-Q1: Over the past 4 weeks ,has the treatment  
you have been taking improved your erectile function?**

**Yes.....**

**No.....**

**GAQ-Q2: If yes, has the treatment improved your ability  
to engage in sexual activity over the past 4 weeks?**

**Yes.....**

**No.....**



# Results of 1 and 3 months follow up

	Patients Initials	Response to PDE5-I	Baseline IIEF-EF Score	month 1 IIEF-EF Score	3 months IIEF-EF Score	Results Comparison	DELTA	Success
1	M I M	YES	9	18	18	Same	9	Yes
2	H I S	NO	9	8	8	Same	1-	No
3	N M M	NO	8	8	8	Same	0	No
4	J H S	YES	17	24	24	Same	6	Yes
5	M N S	YES	14	25	30	Improvement	16	Yes
6	O I S	YES	19	25	25	Same	6	Yes
7	M M K	YES	11	24	24	Same	13	Yes
8	A A D	NO	6	19	19	Same	13	Yes
9	I H A	YES	19	28	28	Same	7	Yes
10	A H	YES	19	28	28	Same	7	Yes
11	S A I	YES	12	20	20	Same	8	Yes
12	A M H	YES	17	24	24	Same	7	Yes

# Results of 1 and 3 months follow up Comparison

- Results are essentially the same.
- Successful results are seen at 1 month post treatment.
- Success is maintained at least 3 months post treatment. Therefore, there is no evident placebo effect.

# Summary

- Initial results at 1 and 3 months show great progress in erectile function.
- *Average IIEF-EF increased from 13.25 to 20.92 (57.86 % improvement).*
- *84 % Success according to success criteria*
- All mild to moderate cases have succeeded.
- One severe case has improved while 2 severe cases failed.
- SEP and GAQ results have improved.
- No pain and no complications were reported.



# Conclusions

- The initial results of 1 and 3 months follow up are very encouraging and indicate success.
- This may be due to perfect organ coverage and direct application to the Crura using a **Linear Focused Shockwave Therapy** device.
- Additional studies with more patients are needed in order to confirm these results.