A Single-Center, Controlled Study to Assess the Effectiveness and Safety of the UltraShape Power System Using U-sculpt Power Transducer for Abdominal Non-Invasive Fat Reduction

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I. INTRODUCTION

The purpose of this clinical performance evaluation was to assess treatment with the UltraShape Power device, using the U-Sculpt Power transducer (ISPPA 660W/cm2), for non-invasive reduction in abdominal circumference. The UltraShape System was previously cleared by FDA for the same indications with ISPPA of 550 W/cm2 (K141708) and 440 W/cm2 (K133238). Therefore, the purpose of this study is to evaluate the safety and performance of the modified UltraShape system using the increased ultrasound power. A total of 43 subjects at one site were enrolled in the study and underwent 3 bi-weekly treatments with the U-Sculpt Power Transducer of the UltraShape Power device.

II. DEVICE INDICATIONS AND DESCRIPTION

The UltraShape Power System delivers focused ultrasound energy that can disrupt subcutaneous adipose tissue (SAT) to provide a non-invasive approach to achieve a desired aesthetic effect. It is intended for non-invasive reduction in abdominal circumference. The UltraShape Power System was previously 510(k) cleared (K133238, K141708) for the same indications. As previously cleared, the UltraShape Power system is comprised of two main parts: the main console, which includes the pulser, touch screen and PC, cooling system, power supply, video camera, and distributor board; and the transducers, which are electro-mechanical devices that convert electrical signals into mechanical (acoustical) energy. The main console hardware and software enable operation of the Transducer Unit. The functionality of the transducer is based on the piezoelectric ceramic acoustics core inside the transducer. When an alternating voltage is applied to the piezoelectric element, it causes the piezoelectric element to oscillate, thus producing ultrasound waves. The spherical shape of the piezoelectric element in the transducer enables the focusing of the ultrasound waves into a narrow focal region. The transducers are nearly identical to the transducers cleared in K141708, except the maximum acoustic intensity for the U-Sculpt Power transducer has been increased from 550 W/cm2 to 660 W/cm2. The purpose of this study is to support clearance for the UltraShape Power System with an increased acoustic energy for the U-Sculpt Power transducer. As previously cleared, the U-Sculpt Power transducer can only be used in Single Focus Deep Mode.

III. STUDY OBJECTIVES AND ENDPOINTS

The study objectives and endpoints are listed below, and are generally consistent with those measured in the previously submitted clinical studies for the UltraShape predicates (K141708, K133238). In addition, the current study also includes evaluations of fat reduction to provide additional efficacy data for the UltraShape Power. No changes to the indications are proposed with this submission.

A. Primary objectives

- Demonstrate the efficacy in abdominal fat reduction at 12 weeks post UltraShape Power treatments.
- Demonstrate the safety of the UltraShape Power treatment.

B. Secondary Objectives

- Evaluate the efficacy in abdominal fat reduction at other time points.
- Assess the comfort level during treatment, as reported by the subjects.
- Assess subjects' satisfaction and improvement, as reported by the subjects.

C. Primary Effectiveness Endpoints

1. Statistically significant abdomen fat reduction post UltraShape Power treatments at 12 weeks follow-up (12wk FU) versus baseline, as measured by Ultrasound (US) Imaging device

D. Secondary Effectiveness Endpoints

1. Statistically significant abdomen fat reduction post UltraShape Power treatment at each visit (starting at the second treatment) compared to baseline, using Ultrasound imaging measurements.
2. Subject's self-assessment for satisfaction and improvement using questionnaires at each follow up visit (starting at the second treatment).
3. Subject's discomfort (pain) level after each treatment (Tx.1, Tx.2 & Tx.3), using a 10-point visual analog scale, Numerical Scale Response (NSR).

E. Primary Safety Endpoint

1. The number, severity and type of any adverse event recorded throughout the study and post treatment (immediate and delayed response).

IV. CLINICAL STUDY RESULTS

A total of 43 subjects were enrolled to the study and underwent three bi-weekly abdomen treatments with the UltraShape Power device using the U-Sculpt Power transducer.

Table 1: Baseline Demographic Distribution

		n	%
All		43	100%
Gender	**Male**	2	5%
	Female	41	95%
Race	**Caucasian**	43	100%
Skin Type	**I**	3	7%
	II	18	42%
	III	14	33%
	IV	7	16%
	V	1	2%
Age Distribution	**<35**	2	5%
	35≤x<45	13	30%
	45≤x<55	22	51%
	55≤x	6	14%

As shown in **Table 2** below, the baseline mean weight and BMI of the 43 subjects were 73.1±13.7 kg and 27.36±4.21 kg/m2, respectively. The baseline midline abdominal circumference measured was 98.4±9.2 cm. The baseline fat thicknesses, as measured by ultrasound, was 1.24±0.44 cm.

Table 2: Baseline Measurements

	Age	Height [m]	Weight [kg]	BMI	Midline abdominal circumference [cm]	Ultrasound Fat Thickness [mm]
Mean	48.4	1.63	73.1	27.36	98.44	12.41
S.D.	7.6	0.07	13.7	4.21	9.16	4.40
Minimum	30	1.48	51.2	20.64	82	3.68
Maximum	65	1.84	110	38.06	123.5	22.48

Treatment duration was also similar for the three sessions: 46±11, 44±10 and 45±12 minutes for the first, second and third treatment, respectively. See **Table 3** below.

Table 3: Treatment duration [minutes] per treatment

	Tx.1	Tx.2	Tx.3
Mean	0:46:04	0:44:12	0:45:32
S.D.	0:11:18	0:09:39	0:12:08
Minimum	0:24:00	0:28:00	0:25:00
Maximum	1:08:00	1:03:00	1:11:00

A. Weight Change

As shown in **Table 4** below, the study subjects showed minimal weight change throughout the study (ranging from no change to 0.2% change at most). Therefore, the circumference reduction results described below are not attributable to weight change, further confirming the robustness of the UltraShape treatment efficacy data.

Table 4: ITT Weight Change [%]

	Tx.2	Tx.3	2 weeks FU (FU1)	4 weeks FU (FU2)	6 weeks FU (FU3)	8 weeks FU (FU4)	10 weeks FU (FU5)	12weeks FU (FU6)
Mean	0.1%	0.1%	0.0%	0.1%	0.0%	-0.1%	-0.2%	-0.2%
S.D.	1.1%	1.4%	1.9%	1.6%	1.7%	2.1%	2.1%	2.2%
Minimum	-1.8%	-4.5%	-2.8%	-3.1%	-4.3%	-4.8%	-4.8%	-5.1%
Maximum	3.8%	3.9%	7.4%	3.9%	3.5%	7.6%	5.7%	6.3%
P-value	0.5793	0.9063	0.5478	0.9090	0.6235	0.5130	0.2521	0.3950

*Wilcoxon Singed Rank Test for Single Group Median

B. Effectiveness Endpoints

1. Abdomen Fat Reduction

The fat layer thickness was measured at each visit (for each treatment visit the measurement was taken prior to the treatments) using ultrasound imaging device.

a) Primary Effectiveness Endpoint: Fat Reduction at 12 weeks, Ultrasound Measurements

The second primary effectiveness endpoint of this study was statistically significant abdomen fat reduction at 12 week follow up. The average percentage reduction of the fat thickness measured by ultrasound imaging was 31.5%±8.3% at 12 week follow-up. The result was statistically significant, with a p-value<0.01 using Wilcoxon single rank test for single group median.

Therefore, the study met the primary effectiveness endpoint.

b) Secondary Effectiveness Endpoint: Fat Reduction by Time, Ultrasound Measurements

The fat layers showed consistent, progressive reduction in thickness over time compared to baseline, with average percentage reduction of 2.5%±16.3%, 10.0%±5.4%, 14.6%±7.1%, 17.4%±5.6%, 18.3%±7.6%, 23.7%±6.5%, 27.9%±7.4% and 31.5%±8.3% for visits 2-9, respectively. See **Table 5** and **Figure 1**. The reduction was statistically significant at all study time points, meeting this secondary effectiveness endpoint.

Table 5: ITT Fat Thickness Reduction – Based on Ultrasound Measurements [%]

	Tx.2	Tx.3	2w FU	4w FU	6w FU	8w FU	10w FU	12w FU
Mean	-5.0%	-10.0%	-14.6%	-17.4%	-18.3%	-23.7%	-27.9%	-31.5%
S.D.	4.1%	5.4%	7.1%	5.6%	7.6%	6.5%	7.4%	8.3%
Minimum	-15.4%	-20.3%	-31.1%	-32.1%	-31.0%	-36.3%	-43.4%	-50.1%
Maximum	3.5%	0.3%	0.6%	-7.7%	-0.3%	-12.1%	-10.0%	-13.9%
P-value*	1.24E-07	3.85E-08	2.85E-06	1.23E-05	1.17E-06	3.79E-06	3.79E-06	3.65E-07

*Wilcoxon Singed Rank Test for Single Group Median

Figure 1: ITT Fat Thickness Reduction – Based on Ultrasound Measurements

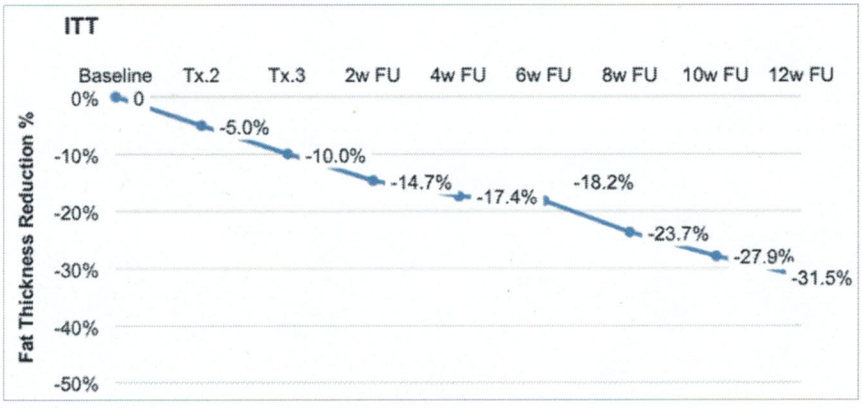
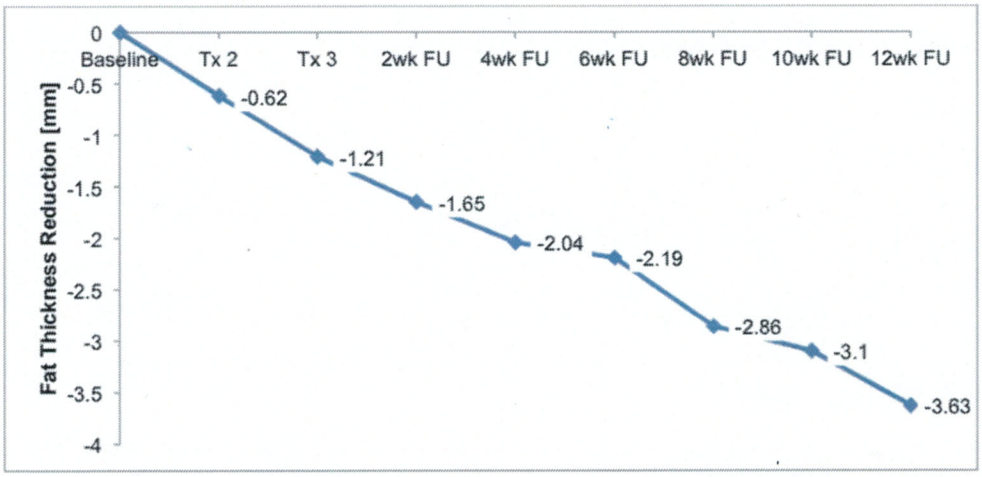


Table 6: ITT Fat Thickness Reduction – Based on Ultrasound Measurements [mm]

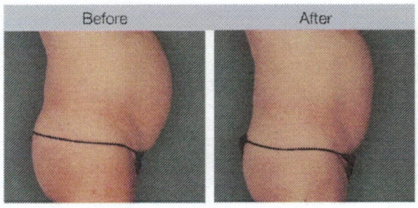
	Tx 2	Tx 3	2wk FU	4wk FU	6wk FU	8wk FU	10wk FU	12wk FU
Mean	-0.62	-1.21	-1.65	-2.04	-2.19	-2.86	-3.10	-3.63
S.D.	0.58	0.83	0.88	1.00	1.19	1.30	1.32	1.50
Minimum	-2.3	-3.54	-3.94	-4.2	-4.75	-5.61	-6.85	-7.96
Maximum	0.69	0.05	0.11	-0.64	-0.05	-0.88	-1.14	-1.2
P-value*	2.97E-08	1.91E-11	7.31E-11	3.33E-10	2.40E-11	4.88E-12	1.15E-12	1.41E-15

Figure 2: ITT Fat Thickness Reduction – Based on Ultrasound Measurements [mm]

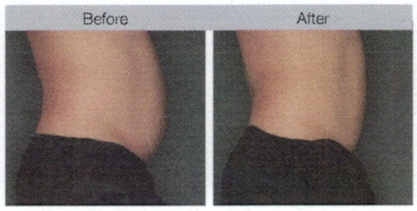


Therefore, the study results met the second secondary effectiveness endpoint by demonstrating statistically significant fat reduction using both percent change and absolute change, at each visit (after the first treatment and before the last follow up) compared to baseline as measured by ultrasound imaging.

Clinical Photographs



Before and after 3 sessions of UltraShape Power
Photos courtesy of Ruthie Amir, MD



Before and after 3 sessions of UltraShape Power
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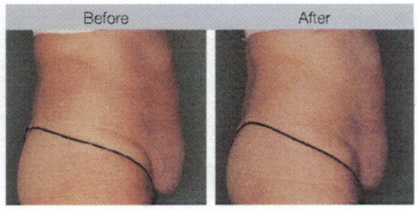


Before and after 3 sessions of UltraShape Power
Photos courtesy of Ruthie Amir, MD

2. Secondary Effectiveness Endpoints: Subject Improvement and Satisfaction

The secondary effectiveness endpoints of the study also assessed subject evaluation of their improvement and satisfaction, based on the questionnaires provided to the subjects at each visit (starting at the second treatment). As discussed further below, the results demonstrated that the subjects reported favorable improvement and satisfaction with the UltraShape Power treatment.

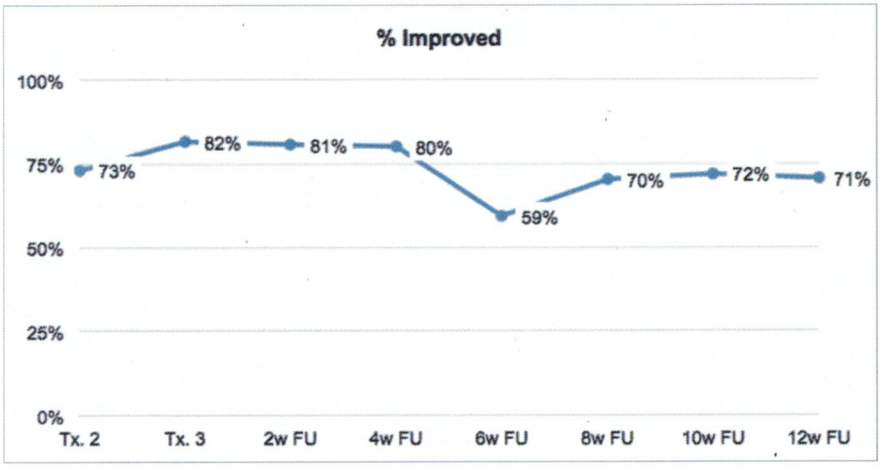
a) Subject Improvement Assessment

Subjects were asked to rank their improvement using a 5-point scale (0=No improvement, 1=Mild improvement, 2=Moderate improvement, 3=Significant improvement, 4=Highly significant improvement). As early as two weeks following the first treatment (prior to the second treatment), 73% of the subjects reported some degree of improvement. As shown in **Table 7** and **Figure 3** below, throughout the study, the majority of the subjects reported improvement from baseline following the first treatment (73%, 82%, 81%, 80%, 59%, 70%, 72% and 71% at the specific visits after the first treatment).

Table 7- Subject Improvement Assessment Distribution

	Tx. 2	Tx. 3	2w FU	4w FU	6w FU	8w FU	10w FU	12w FU
0=No improvement	27%	18%	19%	20%	41%	30%	28%	29%
1=Mild improvement	51%	50%	50%	48%	25%	19%	40%	29%
2=Moderate improvement	15%	21%	15%	12%	13%	26%	16%	21%
3=Significant improvement	7%	11%	12%	20%	22%	22%	12%	18%
4=Highly significant improvement	0%	0%	4%	0%	0%	4%	4%	3%

Figure 3: Subject Improvement Assessment Rate



b) Subject Satisfaction Assessment

Subject satisfaction with the treatment was assessed using two instruments. First, subjects were asked to rank their satisfaction using a 5-point scale (2=Very Satisfied, 1=Satisfied, 0=Indifferent, -1=Disappointed, -2=Very Disappointed). As early as two weeks following the first treatment (prior to the second treatment), 68% of the subjects reported some degree of improvement, and this rate was generally high during the subsequent visits.

Sub-group analysis was conducted on the 9 subjects who were disappointed or very disappointed at 12-week follow up. The results showed that the average midline circumference reduction for this sub-group was 1.33±1.38 cm, and the average fat thickness reduction was 26.4%±8.4%. Although these numbers were lower than the average reductions for the ITT group (average midline circumference reduction of 2.55±2.14 cm and average fat thickness reduction 31.5%±8.3%), the results from this sub-group were still statistically significant when compared to baseline ($P<0.05$, Wilcoxon signed rank test for single group median). In addition, it should also be noted that a greater proportion of subjects in this sub-group reported weight gain (67%, 6/9) during the study compared to the ITT population in general (38%, 13/34). Therefore, although lower reduction results were observed in the subset of subjects who were disappointed with treatment, the results were nonetheless statistically significant, and the reported weight gain could have contributed to the lesser reductions observed. Subject satisfaction was determined based on the subjects' responses to the questions on a scale of -2 (Very Disappointed) to 2 (Very Satisfied). With this assessment, subjects indicated overall satisfaction with the UltraShape Power. Notably, all or nearly all (96%) subjects agreed that the treatment was comfortable throughout each visit. Further, the large majority of subjects also indicated that they would recommend the procedure to a friend or family member when asked at each follow up visit. The responses for each of these questions are summarized below in **Table 8**.

Table 8: Summary of Subject Satisfaction Questionnaire Responses

Question	Response	2w FU	4w FU	6w FU	8w FU	10w FU	12w FU
Would You Recommended This Procedure to a Friend or Family	No opinion	15%	17%	22%	30%	24%	24%
	% agree	81%	83%	66%	63%	72%	62%
How Comfortable Did You Feel During the Treatment	No opinion	0%	0%	0%	4%	4%	0%
	% agree	100%	100%	100%	96%	96%	100%

Therefore, subject improvement and satisfaction results demonstrated that subjects generally found the treatment to be favorable and well-tolerated.

3. Secondary Effectiveness Endpoint: Treatment Discomfort

As a secondary effectiveness endpoint evaluation, following each treatment session, subjects were asked to rank their pain sensation / comfort level during treatment using a 10-point scale (0=no pain at all, 10=worst possible pain). As presented in **Table 9** and **Figure 4** below, the subjects reported no to minimal pain for each of the three treatments. As shown below, subjects reported an average score of 0.81±1.62, 0.49±0.80, and 0.72±1.24 out of 10 after each of the three treatments, respectively. The average discomfort score of all three treatment sessions was 0.67±1.27 out of 10, indicating that the subjects considered treatment with the device to be comfortable. There were no statistically significant differences for the reported comfort/discomfort levels at each of the three sessions (P>0.05, One-Way ANOVA test).

Table 9: Pain sensation during each treatment

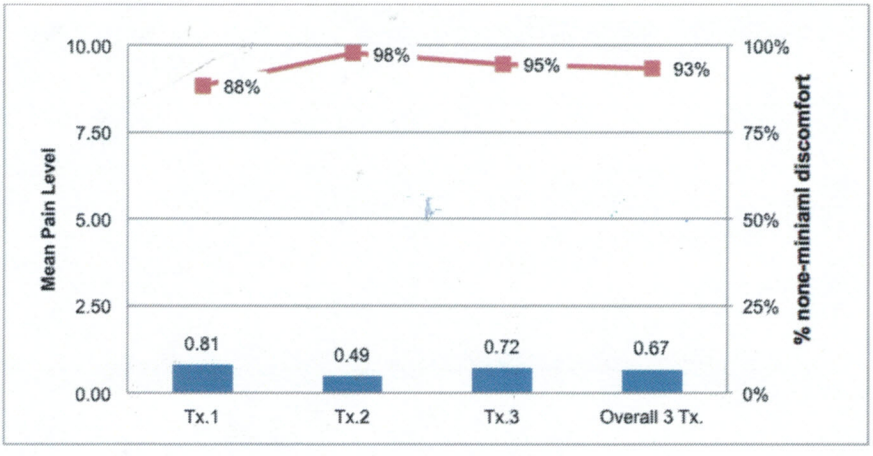
	Tx.1	Tx.2	Tx.3	Overal l
Mean	0.81	0.49	0.72	0.67
S.D.	1.62	0.80	1.24	1.27
Minimum	0	0	0	0
Maximum	8.5	3	5	8.5
P-value (One-Way Anova)	0.49002			

As shown in **Table 10** and **Figure 4**, when the reported pain scores are categorized into quartiles (0-2.5=none to minimal discomfort, 2.5-5=mild discomfort, 5-7.5=moderate pain, 7.5-10=severe pain), results demonstrated that the vast majority of subjects reported "none to minimal" discomfort for each of the treatments (88%, 98% and 95% for the 1st, 2nd and 3rd treatments, respectively). No subject reported "moderate" pain during treatment. One subject reported severe pain (score 8.5) at the first treatment session. At the second session that subject reported no discomfort at all (score 0). At the third session she did not rank the discomfort level. Nonetheless, this subject opted to continue with the study to complete all three treatments. Further, no adverse events or immediate responses following treatment were reported for this subject.

Table 10: Pain Sensation Distribution During Each Treatment

	Tx.1	Tx.2	Tx.3	*Overall 3 Tx.*
# none to minimal (0-2.5)	38 (88%)	40 (98%)	35 (95%)	*113 (93%)*
# mild (2.6-5.0)	4 (9%)	1 (2%)	2 (5%)	*7 (6%)*
# moderate (5.1-7.5)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
# severe (7.6-10)	1 (2%)	0 (0%)	0 (0%)	1 (1%)

Figure 4: Subjects' Discomfort / Pain Sensation During Each Treatment



C. Safety Endpoints

1. Adverse Events

The safety of the UltraShape Power System was evaluated based on the rate of occurrence of adverse events (AE) reported during the study. Adverse events are defined in the study as any undesired clinical occurrence, in a study subject undergoing UltraShape Power treatment, which does not require a causal relationship with the study device. An AE can, therefore, be any unfavorable and unintended sign, symptom, or disease temporarily associated with the use of the UltraShape Power device, whether or not considered related to the device. All adverse events were evaluated by the investigator for severity of the effect and relationship to the device.

No adverse events were observed during the study course. Thus, the study met the primary safety endpoint, and confirmed that the increased acoustic power of the device does not raise new types of safety concerns compared to the UltraShape predicates.

Therefore, the study results demonstrated that the UltraShape Power with increased power has a favorable safety profile that is equivalent to the predicates.

V. CONCLUSION

The results of this prospective clinical study demonstrated the favorable safety and effectiveness profile of the UltraShape Power using the U-Sculpt Power transducer with increased power. The study met the predefined primary efficacy endpoints. Specifically, subjects achieved statistically significant reduction of fat thickness (of 31.5%±8.3%) was observed at final follow up.

The study also met the secondary efficacy endpoints by demonstrating statistically significant reductions in abdomen circumference and fat thickness over time. Trends over time repeatedly demonstrated substantial reductions at each time point across the different assessments.

In addition, sub-group analyses indicated that the significant reduction in circumference and fat thickness were consistently observed in Weight Stable and Per Protocol sub-groups (not included in this report). Therefore, across several assessments, the study demonstrated that the UltraShape Power performs as intended to achieve abdominal circumference reduction.

Overall, subjects reported that they experienced improvement following treatments with the UltraShape Power and were generally satisfied with the treatments. Furthermore, the vast majority of the subjects indicated that device treatment was comfortable with none to minimal pain.

Treatment with the UltraShape Power demonstrated a positive safety profile, with no adverse events.

Thus, the clinical study described above robustly demonstrated that the UltraShape Power using the U-Sculpt Power transducer with increased power presents a strong safety and effectiveness profile for the intended use of abdominal fat reduction. Results remain similar to those of the previously cleared UltraShape predicates, supporting substantial equivalence.