

Glan

*A Three-Phase Evaluation of Pulsed,
High Frequency, Radio Short Waves
(Diapulse). 646 Patients*

Bruce M. Cameron, M.D.

Reprinted from THE AMERICAN JOURNAL OF ORTHOPEDICS March, 1964

	A	C
Males.....	2	5
Females.....	4	3
Same.....	4	6
Better.....	2	2
Worse.....	0	0
S. O. 5th Day..... Yes	1	2
No	5	6
Surgery		
Abdomen.....	4	5
Back.....	1	1
Neck-Chest.....	1	1
Kidney.....	0	0
Extremity.....	0	1
Total.....	6	8

TABLE I—20-30 YRS (STUDY #1).

INTRODUCTION

In 1961 it was reported that there was evidence that the use of pulsed, high-frequency radio short waves stimulated wound healing in animals.¹ As a follow-up to this work, three more studies have been undertaken:

1. A 100 patient, double-blind study on wound healing in surgical patients.
2. An 81 patient, non-controlled study on wound healing in orthopedic, surgical patients.
3. A 465 patient study, non-controlled on non-surgical, orthopedic patients.

These observations are included because it was reasoned that if there were a stimulus to wound-healing (one of the simplest of all reparative processes), then there would be a stimulus to the healing of sprains, contusions, and other conditions requiring the same reparative processes.

Hence, this study comprises clinical observations on 646 patients.

	A	C
Males.....	1	1
Females.....	4	2
20-30 Yrs.....	1	1
31-50 Yrs.....	3	2
51-75 Yrs.....	1	0
Same.....	3	2
Better.....	1	1
Worse.....	1	0
S. O. 5th Day..... Yes	1	2
No	4	1
Total.....	5	3

TABLE V—NECK AND CHEST SURGERY (STUDY #1).

	A	C
Males.....	10	4
Females.....	19	24
Same.....	10	7
Better.....	18	20
Worse.....	1	1
S. O. 5th Day..... Yes	8	17
No	21	11
Surgery		
Abdomen.....	18	16
Back.....	4	4
Neck-Chest.....	3	2
Kidney.....	1	2
Extremity.....	3	4
Total.....	29	28

TABLE II—31-50 YEARS (STUDY #1).

MATERIALS AND METHODS

1. The 100 patient, double blind study: these were consecutive, unselected, surgical cases performed at a local hospital in Houston, Texas. The surgeons were contacted and asked for permission to use this modality

A Three-Phase Evaluation of Pulsed, High Frequency, Radio Short Waves (Diapulse). 646 Patients

Bruce M. Cameron, M.D.

on their cases. Most of the physicians were unfamiliar with Diapulse, but when reassured that it would not be harmful, agreed to its application. For their co-operation, this author is grateful. None of the author's cases were used.

	A	C
Males.....	2	2
Females.....	3	5
20-30 Yrs.....	0	1
31-50 Yrs.....	3	4
51-75 Yrs.....	2	2
Same.....	3	0
Better.....	2	7
Worse.....	0	0
S. O. 5th Day..... Yes	1	7
No	4	0
Total.....	5	7

TABLE VI—EXTREMITY SURGERY (STUDY #1).

	A	C
Males.....	5	4
Females.....	10	10
Same.....	12	4
Better.....	2	10
Worse.....	1	0
S. O. 5th Day..... Yes	0	5
No	15	9
Surgery		
Abdomen.....	12	11
Back.....	0	1
Neck-Chest.....	1	0
Kidney.....	0	0
Extremity.....	2	2
Total.....	15	14

TABLE III—51-75 YEARS (STUDY #1).

The patients were divided into two groups of 50 each (Groups A and C). In the A group, the machine was adjusted so that it would not operate, but gave the appearance of doing so; in group C, the machine operated normally.

One technician was used for all cases and neither he nor the patients knew which was the effective machine. Neither the concerned surgeon nor the author knew which machine was effective; the only person who did was a secretary whose responsibility it was to keep the records.

	A	C
Males.....	12	7
Females.....	22	25
20-30 Yrs.....	4	6
31-50 Yrs.....	19	15
51-75 Yrs.....	11	11
Same.....	19	13
Better.....	14	18
Worse.....	1	1
S. O. 5th Day..... Yes	7	9
No	27	23
Total.....	34	32

TABLE VII—ABDOMINAL SURGERY (STUDY #1).

	A	C
Males.....	0	0
Females.....	1	2
20-30 Yrs.....	0	0
31-50 Yrs.....	1	2
51-75 Yrs.....	0	0
Same.....	0	1
Better.....	1	1
Worse.....	0	0
S. O. 5th Day..... Yes	0	0
No	1	2
Total.....	1	2

TABLE IV—KIDNEY SURGERY (STUDY #1).

Each patient was treated twice a day, four days: 20 minutes over the liver and 20 minutes over the wound (400 pulses, 4 inches penetration). At the end of the total treatment, the surgeon was given a questionnaire which asked whether or not the patient's post-operative condition was the same, better, or worse (as compared with his other patients, in his experience, with similar conditions). It also asked whether or not the sutures were removed on or before the fifth post-operative day, and he was asked for further comments.

The secretary checked the records later as to dismissal date to ascertain patient days and to check other pertinent information: age, sex, type of incision, and area of surgery.

2. The 81 patient study: these were unselected, consecutive, orthopedic, surgical patients, who were operated between July, 1961 and May, 1962. These were routine procedures; and in the hospital, they were all given the routine, four-day treatment with an active machine as outlined in the 100 patient double-blind study. These

	A	C
Males.....	2	3
Females.....	3	3
20-30 Yrs.....	1	0
31-50 Yrs.....	3	5
51-75 Yrs.....	1	1
Same.....	1	1
Better.....	4	5
Worse.....	0	0
S. O. 5th Day..... Yes	0	6
No	5	0
Total.....	5	6

TABLE VIII—BACK SURGERY (STUDY #1).

	A	C
Males.....	10	6
Females.....	16	11
20-30 Yrs.....	4	6
31-50 Yrs.....	10	7
51-75 Yrs.....	12	4
S. O. 5th Day..... Yes	2	4
No	24	13
Total.....	26	17

TABLE IX—"SAME" GROUP (STUDY #1).

patients were studied in the same fashion outlined above and the results compared.

3. The 465 patient study of non-operative cases:

Type of Surgery	Hospital Days		No. Patients		Patient Days	
	A	C	A	C	A	C
Abdomen.....	362	295	34	32	10.6	9
Back.....	46	58	5	6	9	9
Neck and Chest....	33	19	5	3	6.6	5.1
Extremity.....	65	80	5	7	13	11
Kidney.....	10	19	1	2	10	9

TABLE XIII—HOSPITAL DAYS—POST SURGICAL (STUDY #1).

these were consecutive office, orthopedic patients on whom this modality was used. The usual routine was to administer this twice a day, Monday, Wednesday, and Friday for two weeks; then twice a day on Monday and Friday; then once a week, twice that day. It was used as an adjunct to the other well known methods of therapy, and in no case was it the sole treatment if other methods were indicated.

The patients were studied as to age, sex, length of treatment, diagnosis, and results.

Time	Number	Percent
1-7 Days.....	14	3.0
1-2 Weeks.....	32	6.9
2-3 Weeks.....	20	4.3
3-4 Weeks.....	51	11.0
1-2 Months.....	77	16.5
2-3 Months.....	35	7.5
3-4 Months.....	60	12.9
4-5 Months.....	31	6.7
5-6 Months.....	44	9.5
6 + Months.....	101	21.7
TOTAL.....	465	100.0

TABLE XVII—LENGTH OF TREATMENT (STUDY #3).

	A	C
Males.....	1	0
Females.....	1	1
30-50 Yrs.....	1	1
51-75 Yrs.....	1	0
S. O. 5th Day..... Yes	0	0
No	2	1
Total.....	2	1

TABLE X—"WORSE" GROUP (STUDY #1).

RESULTS

The 100 patient double-blind study. Apparently the effect of age was equivocal. There was as much stimulation in the old as the young (Table I-III).

Males.....	37	20-30 Yrs.....	18
		31-50 Yrs.....	49
		51-75 Yrs.....	14
Females.....	44	Surgery	
		Back.....	38
		Extremity.....	42
Same.....	6	S. O. 5th Day	
Better.....	69	Yes.....	70
Worse.....	6	No.....	11
Total Patients....	81	Total Post Surgical Days..	786
Post Surgical Average Days 9.8			
July 7, 1961, through May 15, 1962			

TABLE XIV—DIAPULSE SURGICAL PATIENTS (STUDY #2).

Site of surgery: in extremity and back surgery all treated patients had their sutures removed by the fifth post-op day; and out of 13 patients, 12 were reported as better. There was not enough kidney, and neck and chest surgery to be significant. The results of abdominal surgery showed a very little improvement with treatment and little or no improvement as regards removal of sutures. Fourteen on the untreated group were reported as better which suggests a psychological response (Tables IV-VIII).

The groups analyzed as to same, better and worse showed that only one was made worse (this was a moribund, cancer patient), 32 better, and 17 remained the same. In the untreated group, 26 remained the same, 22 had a psychological stimulation, and two were made

Diagnosis	Number	Percent	Complications	No.
Cervical Spine.....	118	24.9	Septic Arthritis.....	3
Dorsal Spine.....	17	3.6	Rheumatoid A.....	6
Lumbar Spine.....	118	25.8	Hypertrophic A.....	37
Sacrum.....	12	2.6	Gouty Arthritis.....	10
Upper Extremity Fractures	37	8.0	Osteoporosis.....	17
Upper Extremity General	30	6.5	Osteomyelitis.....	11
Lower Extremity Fractures	61	13.1		
Lower Extremity General	73	15.7		
Total.....	485	100.0		84

TABLE XVIII—DIAGNOSES (STUDY #3).

	A	C
Males.....	7	7
Females.....	15	25
20-30 Yrs.....	2	2
31-50 Yrs.....	18	20
51-75 Yrs.....	2	10
S. O. 5th Day..... Yes	7	20
No	15	12
Total.....	22	32

TABLE XI—"BETTER" GROUP (STUDY #1).

worse by no treatment (Tables IX-XI).

Total patient evaluation: the results showed stimulation of wound healing to a conservative degree. Most of the

Sex	Number	Percent
Males.....	241	51.8
Females.....	224	48.2
Total.....	465	100.0

TABLE XV—SEX (STUDY #3).

patients who had their sutures removed by the fifth day were orthopedic cases and this may have something to do with the report by Erdman of peripheral stimulation. It may also be related to the fact that abdominal surgeons are loath to remove their sutures early for fear of wound dehiscence, although 18 were reported as improved (Table XII).

The hospital days were analyzed and in every case except the backs there was a moderate reduction of hospitalization (Table XIII).

THE 81 PATIENT STUDY

This is recorded in Table XIV. It essentially demonstrates a short hospital stay, in spite of the fact that some of the cases were those of osteomyelitis.

THE 465 PATIENT STUDY

There was no appreciable difference between males and females (Table XV). There were 49.4 percent between 30 and 50 years of age and less than 2 percent under 10 years of age (Table XVI).

Grade	Number	Percent
Excellent.....	284	61.3
Good.....	106	22.6
Fair.....	49	10.5
Poor.....	26	5.6
+ Total.....	465	100.0

TABLE XIX—RESULTS (STUDY #3).

	A	C
Males.....	17	13
Females.....	33	37
20-30 Yrs.....	6	8
31-50 Yrs.....	29	28
51-75 Yrs.....	15	14
Same.....	26	17
Better.....	22	32
Worse.....	2	1
S. O. 5th Day..... Yes	9	24
No	41	26
Total Treated.....	50	50

TABLE XII—TOTAL PATIENT EVALUATION (STUDY #1).

Age	Number	Percent
0-10 years.....	8	1.7
10-20 years.....	56	12.1
20-30 years.....	69	14.8
30-40 years.....	117	25.1
40-50 years.....	113	24.3
50-60 years.....	65	14.0
60 + years.....	37	8.0
Total.....	465	100.0

TABLE XVI—AGE (STUDY #3).

The length of treatment varied from one day to over six months. Only 3 percent responded within one week; 6.9 percent within two weeks; 4.3 percent within three weeks and 11 percent within one month. Sixteen percent

Type of Treatment	Number
Clinic Physiotherapy*.....	158
Traction.....	65
Steroids (Joint Injection).....	57
Supports (Neck and Back).....	154
Exercises.....	96
Muscle Relaxants.....	209
Plaster of Paris Casts.....	69
Conservative Care in Hospital.....	57
Surgery.....	163
Diet.....	18
Total.....	1,046

* Clinic Physiotherapy consisted of heat and massage.

TABLE XX—OTHER TREATMENT (STUDY #3).

responded within one to two months. Thus, 41.7 percent responded within two months treatment, whereas 21.7 percent received therapy six months or more (Table XVII).

Diagnosis was listed as to site: one of the various parts of the spine and the upper and lower extremities. The diagnoses have about the same percentages as to type as is found in any orthopedic office. Over 50 percent of the cases were from conditions of the spine, whereas the rest were of the extremities. Secondary diagnosis

Description	Number	Percent
Males.....	156	55.0
Females.....	128	45.0
Total.....	284	100.0
0-10 Years.....	6	2.0
10-20 Years.....	37	13.1
20-30 Years.....	52	18.3
30-40 Years.....	74	26.1
40-50 Years.....	58	20.4
50-60 Years.....	39	13.7
60 + Years.....	18	6.4
Total.....	284	100.0
1-7 Days.....	10	3.5
1-2 Weeks.....	23	8.0
2-3 Weeks.....	17	6.0
3-4 Weeks.....	31	10.9
1-2 Months.....	62	21.9
2-3 Months.....	23	8.1
3-4 Months.....	45	15.9
4-5 Months.....	18	6.3
5-6 Months.....	25	8.8
6 + Months.....	30	10.6
Total.....	284	100.0

Diagnosis	Number	Percent	Complications	No.
Cervical Spine.....	66	23.3	Septic Arthritis.....	1
Dorsal Spine.....	12	4.2		
Lumbar Spine.....	71	25.0		
Sacrum.....	6	2.1	Rheumatoid A.....	3
Upper Extremity Fractures.....	27	9.5	Hypertrophic A.....	14
Upper Extremity General.....	21	7.4	Gouty Arthritis.....	2
Lower Extremity Fractures.....	35	12.3	Osteoporosis.....	7
Lower Extremity General.....	46	16.2	Osteomyelitis.....	6
Total.....	284	100.0		33

Description	Number
Clinic Physiotherapy.....	91
Traction.....	31
Steroids (Joint Injection).....	36
Supports (Neck and Back).....	47
Exercises.....	55
Muscle Relaxants.....	121
Plaster of Paris Casts.....	40
Conservative Care in Hospital.....	18
Surgery.....	106
Diet.....	6
Total.....	591

TABLE XXI—EXCELLENT RESULT (STUDY #3).

included the various types of arthritides, the most common being hypertrophic arthritis (Table XVIII).

The results shown in Table XIX were rated as Excellent (61.3%), Good (22.6%), Fair (10.5%) or Poor (5.6%). Excellent meant that the patient had no symptoms which would disable him from work and that he did not need further immediate care (Table XXI). Good meant that the patient responded well to therapy; however, this recovery was not as dramatic as the excellent group. All the good group were dismissed from further immediate treatment and then returned to

normal routine (Table XXII). Fair meant that the patient had low grade symptomatology causing him not to be disabled but which required conservative management such as aspirin, heat, and massage; however, they apparently had been helped by the Diapulse treatment (Table XXIII). Poor results were the patients who consistently had stiffness of joints, tenderness, spasm, and who complained of pain, gross disability, and were unable to work. This group was not helped by the treatment administered and it was obvious that they needed

Description	Number	Percent
Males.....	55	52.0
Females.....	51	48.0
Total.....	106	100.0
0-10 Years.....	2	1.9
10-20 Years.....	11	10.4
20-30 Years.....	11	10.4
30-40 Years.....	25	23.6
40-50 Years.....	31	29.2
50-60 Years.....	15	14.1
60 + Years.....	11	10.4
Total.....	106	100.0
1-7 Days.....	3	2.8
1-2 Weeks.....	1	0.9
2-3 Weeks.....	16	15.2
3-4 Weeks.....	13	12.4
1-2 Months.....	10	9.4
2-3 Months.....	4	3.8
3-4 Months.....	10	9.4
4-5 Months.....	10	9.4
5-6 Months.....	28	26.4
Total.....	106	100.0

Diagnosis	Number	Percent	Complications	No.
Cervical Spine.....	25	24.5	Septic Arthritis.....	2
Dorsal Spine.....	3	2.8		
Lumbar Spine.....	26	24.5		
Sacrum.....	4	3.8	Hypertrophic A.....	12
Upper Extremity Fractures.....	8	7.5	Gouty Arthritis.....	4
Upper Extremity General.....	5	4.7	Osteoporosis.....	4
Lower Extremity Fractures.....	18	16.9	Osteomyelitis.....	4
Lower Extremity General.....	17	16.0		
Total.....	106	100.0		28

Description	Number
Clinic Physiotherapy.....	31
Traction.....	18
Steroids (Joint Injection).....	13
Supports (Neck and Back).....	41
Exercises.....	47
Muscle Relaxants.....	29
Plaster of Paris Casts.....	22
Conservative Care in Hospital.....	16
Surgery.....	42
Diet.....	7
Total.....	266

TABLE XXII—GOOD RESULT (STUDY #3).

another type of therapy such as surgery. Some of these were psychoneurotic who did not respond to anything (Table XXIV).

In no case was this the only modality used. Most often, it was combined with another type of treatment and as an adjunct. Most of these are listed in Table XX and indicate conservative management in all but 163 operations. The total is listed as 1,046, and no attempt was made to break down each therapy per patient.

The excellent results were analyzed in Table XXI and it was found that there were no outstanding pointers

in sex and age, but over 40 percent responded within two months and the second largest between three and four months. Ten required more than six months treatment. The breakdown as to location was not remarkable and there were 33 secondary diagnoses. Most of the operations were in this group.

The good results in Table XXII show no difference as to age or sex but demonstrate that more than 26 percent required more than six months treatment, but over 40 percent responded within one to two months. The loca-

Description	Number	Percent
Males.....	19	38.7
Females.....	30	61.3
Total.....	49	100.0
0-10 Years.....	0	0
10-20 Years.....	8	16.3
20-30 Years.....	4	8.2
30-40 Years.....	13	26.5
40-50 Years.....	13	26.5
50-60 Years.....	8	16.3
60 + Years.....	3	6.2
Total.....	49	100.0
1-7 Days.....	1	2.0
1-2 Weeks.....	2	4.0
2-3 Weeks.....	0	0
3-4 Weeks.....	7	14.3
1-2 Months.....	1	2.0
2-3 Months.....	2	4.1
3-4 Months.....	4	8.2
4-5 Months.....	3	6.2
5-6 Months.....	7	14.3
6 + Months.....	22	44.9
Total.....	49	100.0

Diagnosis	Number	Percent	Complications	No.
Cervical Spine.....	12	24.4	Hypertrophic A.....	5
Dorsal Spine.....	1	2.0		
Lumbar Spine.....	14	28.6		
Sacrum.....	2	4.1	Gouty Arthritis.....	3
Upper Extremity Fractures.....	2	4.1	Osteoporosis.....	5
Upper Extremity General.....	3	6.2	Osteomyelitis.....	1
Lower Extremity Fractures.....	6	12.2		
Lower Extremity General.....	9	18.4		
Total.....	49	100.0		14

Description	Number
Clinic Physiotherapy.....	22
Traction.....	7
Steroids (Joint Injection).....	6
Supports (Neck and Back).....	18
Exercises.....	9
Muscle Relaxants.....	26
Plaster of Paris Casts.....	6
Conservative Care in Hospital.....	9
Surgery.....	13
Diet.....	5
Total.....	121

TABLE XXIII—FAIR RESULT (STUDY #3).

tion of diagnosis was almost the same as the excellent group and there were 26 secondary diagnoses. There were 42 operations here compared to 106 in the excellent group.

The fair results (Table XXIII) demonstrated that there were 23 percent more females and the age group was about the same. Almost 60 percent had treatment between five and six months plus and failed to respond. The location of diagnosis was the same, and treatment consisted mainly of clinic physiotherapy, supports, and muscle relaxants; there were 13 surgeries.

In the poor results (Table XXIV) there were 16 percent more females and most were between 30 and 50 years of age. None had any response within one month, and only 3.8 percent showed any improvement within two months. About 85 percent had treatment between five and six months plus without response.

Over 80 percent of diagnoses were within the spine and 50 percent of the total were in the neck. Treatment consisted mainly of physiotherapy, muscle relaxants, and traction; and only four of these were operated.

Description	Number	Percent
Males.....	11	42.3
Females.....	15	58.7
Total.....	26	100.0
0-10 Years.....	0	0
10-20 Years.....	0	0
20-30 Years.....	2	7.7
30-40 Years.....	11	42.3
40-50 Years.....	5	19.2
50-60 Years.....	3	11.5
60 + Years.....	5	19.2
Total.....	26	100.0
1-7 Days.....	0	0
1-2 Weeks.....	0	0
2-3 Weeks.....	0	0
3-4 Weeks.....	0	0
1-2 Months.....	1	3.8
2-3 Months.....	0	0
3-4 Months.....	3	11.5
4-5 Months.....	0	0
5-6 Months.....	2	7.7
6 + Months.....	20	77.0
Total.....	26	100.0

Diagnosis	Number	Percent	Complications	No.
Cervical Spine.....	13	50.0	Osteoarthritis.....	5
Dorsal Spine.....	1	3.8		
Lumbar Spine.....	8	30.8		
Sacrum.....	0	0	Rheumatoid A.....	1
Upper Extremity Fractures.....	2	7.7	Hypertrophic A.....	3
Upper Extremity General.....	1	3.8	Gouty Arthritis.....	1
Lower Extremity Fractures.....	2	7.7	Osteoporosis.....	1
Total.....	26	100.0		

Description	Number
Clinic Physiotherapy.....	14
Traction.....	9
Steroids (Joint Injection).....	2
Supports (Neck and Back).....	8
Exercises.....	3
Muscle Relaxants.....	15
Plaster of Paris Casts.....	1
Conservative Care in Hospital.....	12
Surgery.....	4
Total.....	68

TABLE XXIV—POOR RESULT (STUDY #3).

It is apparent from this study that more females became chronic, that most patients responded to an excellent or good result within two months and relatively few within two weeks. The older age group was in the poor result and there was no appreciable significance to response as to age in the excellent, good, or fair results. About 150 cases of surgery responded in a good and excellent fashion, whereas 17 were in the fair-poor group.

The group which responded in the good to excellent results within three weeks constituted less than 20 percent of the total.

CONCLUSIONS

The use of pulsed, high-frequency, radio short waves as an agent of wound healing was found to be of moderate value in a preliminary 100 patient double-blind study. There has been an improvement in the general condition, in the early removal of sutures, and in the shortening of hospitalization. One case was made worse by treatment, but this was a moribund cancer patient who subsequently died. The most pronounced effect was noted in extremity and back surgery and the least in abdominal surgery. Notwithstanding skepticism and doubt, this initial study demonstrated conservative, favorable results which warrant further investigation.

It is the opinion of this observer that these results in the 465 patient study are as objective as can be. Acute trauma and conditions such as bursitis, sprains and strains seem to have responded the best. However, from these statistics it is apparent that less than 20 percent were well within three to four weeks, which is about what one would expect normally, in a large practice. It is difficult to say statistically, for certain whether Diapulse helped these acute conditions consistently or not, although it is the author's impression that it did. Who, really, can be statistically positive about human beings with all their variables?

In the chronic cases (three months or more) it is again difficult to say whether or not Diapulse was an aid because most of these cases respond within that length of time, notwithstanding. More work is indicated

to find the exact role of treatment that Diapulse should play in the treatment of patients, but for certain, no one of this group was harmed by the treatment.

Again, it is the impression that it is excellent in acute conditions such as wounds, acute inflammation, septic conditions, acute sprains and strains; but this cannot be verified by objective, statistical studies at the present time. Just as this cannot be verified, it cannot specifically be denied. This last statement is based on the fact that here were six excellent results of osteomyelitis, one excellent result of septic arthritis, and four good results on osteomyelitis, one fair result of osteomyelitis, and two good results in septic arthritis.

Although in Tables XXI-XXIV various types of arthritides are listed as complications, this is by no means a statement that Diapulse healed arthritis, gout, osteoporosis, or osteomyelitis. It was used as an aid to treatment and an excellent result from osteoarthritis and rheumatoid arthritis was obtained by arthrodesis, etc. Gout, rheumatoid arthritis, osteoporosis, and osteomyelitis were all placed upon appropriate treatment with Diapulse as an aid and there were excellent to good results as noted. This is again to emphasize that Diapulse does not cure arthritis.

I think it would be most helpful if someone would fully analyze 500 consecutive cases in a busy orthopedist's office whose patients were not given Diapulse and compare their results to these.

REFERENCES

- ¹ GINSBERG, A. J.: Personal Communication.
- ² SHIFFMAN, M. and SAFFORD, F. K., JR.: Pulsating High Voltage Short Wave; A Preliminary Clinical Report. *The Physiotherapy Review*, 23: 1943.
- ³ LOMBARDO, S. S.: Treatment of Decubitus Ulcers. Presented at Symposium Given by The Dr. Abraham J. Ginsberg Foundation For Medical Research, June 29, 1959.
- ⁴ GINSBERG, A. J.: Pulsed Short Wave in the Treatment of Bursitis With Calcification. *International Record of Medicine*, 174: 1961.
- ⁵ LEVY, H.: Pulsed Short Wave in Sinus and Allied Conditions in Childhood. *Western Medicine*, 2: 1961.
- ⁶ BORROW, M. L. and LOBELL, M. J.: Pulsed High Frequency and Routine Hospital Antibiotic Therapy in the Management of Pelvic Inflammatory Disease. In Press.
- ⁷ NADASDI, M.: Inhibition of Experimental Arthritis by Athermic Pulsating Short Waves in Rats. *American Journal of Orthopedics*, 2: 105-107, 1960.
- ⁸ ERDMAN, W. J., II: Peripheral Blood Flow Measurements During Application of Pulsed High Frequency Currents. *American Journal of Orthopedics*, 2: 196-197, 1960.
- ⁹ CAMERON, B. M.: Experimental Acceleration of Wound Healing. *American Journal of Orthopedics*, 3: 336-343, 1961.

