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Reduction of Cost of Dornier HM3 Treatment by Using Refurbished Electrodes

R. SCHLICK, M.D., W. DE RIESE, M.D., CH. STIEF, M.D., M. DJAMILIAN, M.D., E.P. ALLHOFF, M.D., and U. JONAS, M.D.

ABSTRACT

Patients with urolithiasis were randomly assigned to treatment with either original (N = 138) or refurbished (N = 125) electrodes on the Dornier HM3 lithotripter. There were no significant differences in stone burden, position, or radiopacity; frequency of pretreatment stent insertion; or generator voltage and number of shock waves in the two groups. The immediate success rates for renal pelvis stones were 77% in both groups; the rates of caliceal stones were 88% (original electrodes) and 83% (refurbished electrodes) and the rates for ureteral stones 72% (original electrodes) and 80% (refurbished electrodes). These differences were not statistically significant. It should be possible to reduce the cost of extracorporeal lithotripsy without compromise of treatment quality by using refurbished electrodes.

INTRODUCTION

THE FIRST CLINICAL DESTRUCTION of a renal stone by extracorporeal shock wave lithotripsy (SWL) was performed in the early 1980s in Munich.[1] During the ensuing years, SWL has become the most common procedure for the treatment of urolithiasis as the indications have been extended to encompass more than 90% of all stones, including those in the middle and lower ureter.[2]

Lingeman et al[3] estimated the costs of the various treatments for urolithiasis in the United States in 1984 and 1985 and found that SWL was less expensive than open surgery or percutaneous nephrolithotomy (PNL). However, SWL and PNL were nearly the same cost, and the groups of patients treated with the two methods proved not to be comparable. Moreover, the different stone positions and the details of the effectiveness of treatment were not reported. Despite numerous publications concerning the clinical results of SWL, little information is available on the cost-effectiveness ratio.

With modified generator systems, it has become possible to provide anesthesia-free SWL for outpatients with a reduction in the cost, which might be of special interest in the US. In Germany, a reduction of the cost with this type of treatment has not been achievable so far.[4] According to a new refurbishment process developed by Retrode, Inc. (Kennesaw, GA), the tips of the lithotripter electrodes are checked by a special optical device. The gap distance is corrected to within 0.0004 inch, and the F1 position and coaxial alignment are restored. The refurbishing process consists of more than 40 individual steps (Fig. 1). We undertook this study to determine whether the cost-effectiveness of a spark-gap lithotripsy system could be increased by using recycled electrodes without compromise of treatment effectiveness.

MATERIALS AND METHODS

Patients (N = 263) were randomly assigned to two groups, one (Group 1) being treated with the original electrodes (OE) and the other (Group 2) with refurbished electrodes (RE). The average age of the 138 patients in Group 1 was 56 years (range 19–81) (Table 1). Five patients suffered from inadequate disintegration of a stone during previous SWL. The average age of the 125 patients in Group 2 was 54 years (range 19–84). Four had previously undergone SWL and had residual concretements. Statistically, there were no significant differences between the two groups in stone mass, stone position, or radiopacity of the stones.

Department of Urology, Hannover Medical School, Hannover, Germany.

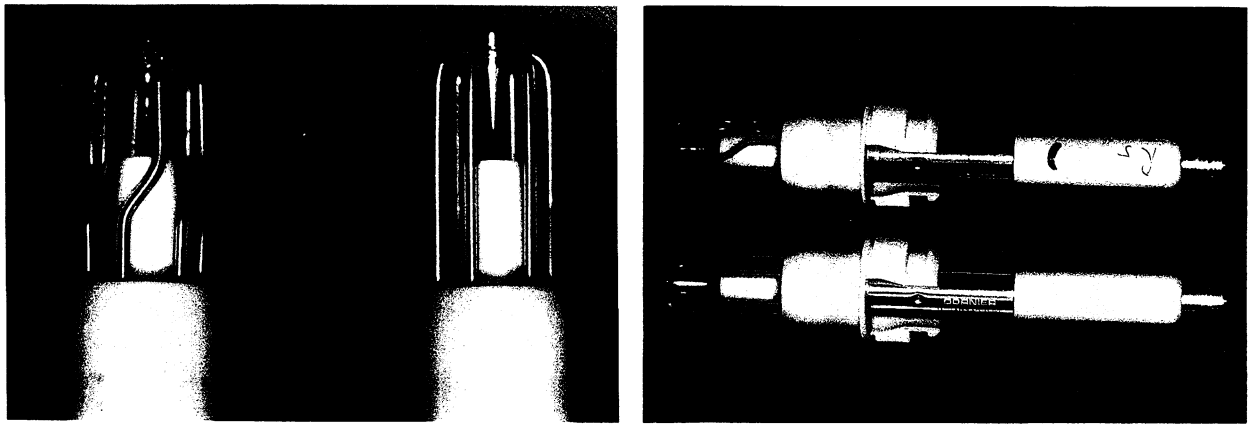

FIG. 1. Tips of electrodes and electrodes complete (refurbished electrode left resp. above).

All patients underwent SWL with the Dornier HM3. The urologist in charge of the treatment did not know whether an OE or an RE was used. In both groups, PDA anesthesia was used in about 60% of cases (81 in Group 1 and 77 in Group 2). Auxilliary stenting was necessary before SWL in about 40% of both groups either because of obstruction (15 patients in Group 1, 12 in Group 2) or because of the large stone mass (41 and 40 patients, respectively). Documentation of the treatment result was done by plain film no later than 12 hours after SWL. Evaluation of the films was performed by a physician without knowledge of the electrode used. The outcome was rated very good if all fragments were <3 mm, good if all fragments were <5 mm, and poor if fragments >5 mm were seen.

RESULTS

Experimental Studies

In vitro experiments with a standardized stone model showed identical performance of the OE and RE in stone destruction (Fig. 2). The usable life-cycles of the two types were likewise found to be similar (Fig. 3). The pressure profiles at F2 were within the standard 10% to 15% statistical variation (Fig. 4).

Clinical Findings

There were no statistically significant differences in number of shock waves and generator voltage needed in the two groups (Table 2). Patients who had already been treated with SWL were not studied further because of their small number. With the OE, good to very good destruction was obtained in 80% of stones overall (Table 2). Insufficient destruction was seen for two renal pelvic, one caliceal, and three ureteral stones (4.5% of the total). With the RE, good to very good destruction was seen in 81% overall. Poor results were obtained with only two pelvic, one caliceal, and three ureteral stones (5%). Statistically, there were no significant differences.

DISCUSSION

Originally and today, electrodes are a source of additional cost in extracorporeal systems. For this reason, alternatives, including new machine designs, have been sought. One possibility is to recycle burned out electrodes, but if this is done, one should demand of the manufacturer a guarantee that the performance and effectiveness are similar to that of the originals.

TABLE 1. CHARACTERISTICS OF STONE DISEASE IN TREATED PATIENTS

	Group 1 (OE)		*Group 2 (RE)*	
Site	*No.*	*Mean Size (Range) (mm)*	*No.*	*Mean Size (Range) (mm)*
Renal pelvis	35	12.9 (5-24)	31	12.6 (5-25)
Calices	59	12.1 (5-25)	55	12.3 (5-40)
Ureter	39	8.9 (5-13)	35	8.2 (5-15)

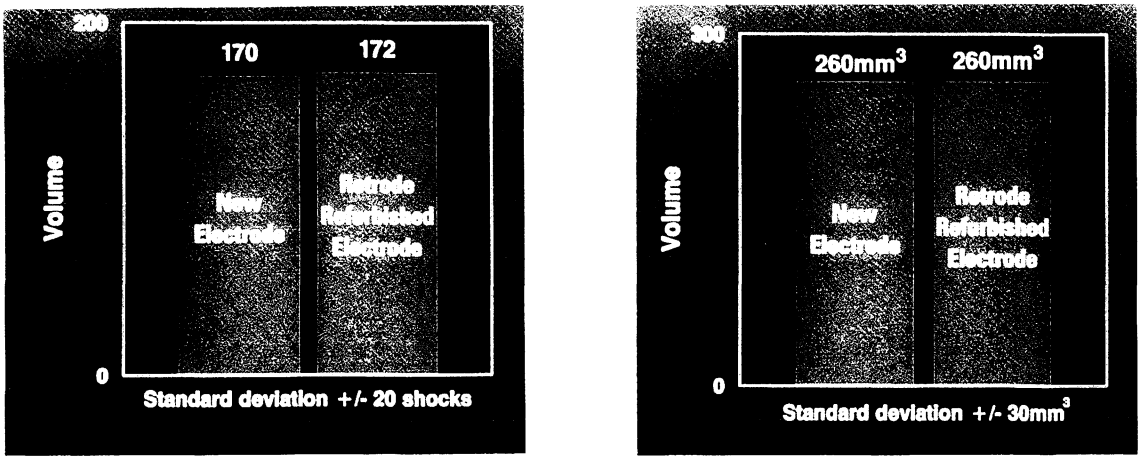

FIG. 2. In vitro fragmentation comparison. *A*. Number of shocks needed to destroy 12-mm spherical test stone (<1.0 × 1.4 mm) completely. *B*. Crater volume produced in test stone by 100 shocks at 24 kV (40 nF) generator voltage. (Courtesy of Retrode, Inc.)

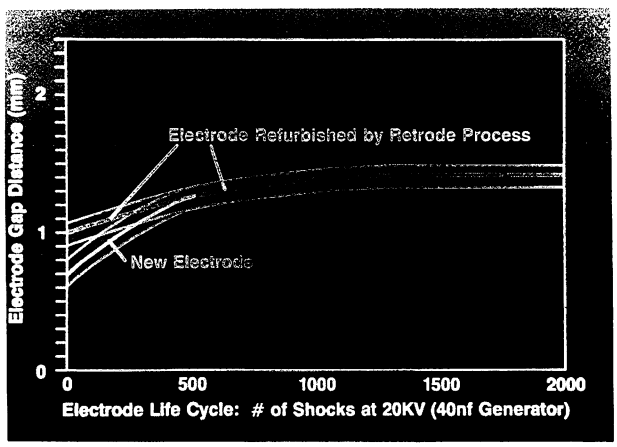

FIG. 3. Life cycles of new and refurbished electrodes. (Courtesy of Retrode, Inc.)

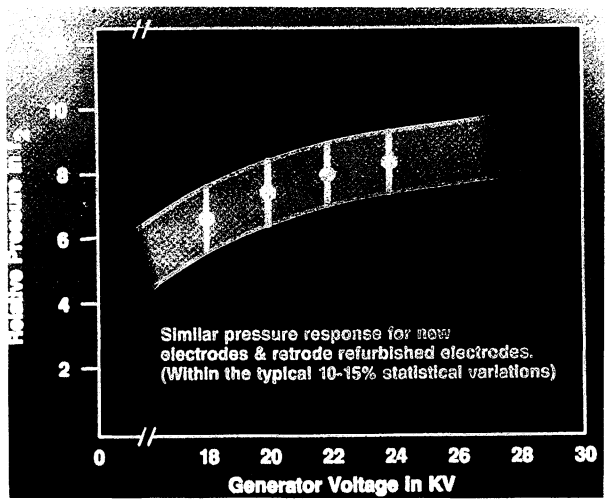

FIG. 4. Pressure profiles at F2 for new and refurbished electrodes. (Courtesy of Retrode, Inc.)

TABLE 2. TREATMENT DETAILS IN TWO GROUPS

	OE		*RE*	
	Average	*Range*	*Average*	*Range*
Renal pelvic stones				
Generator voltage (lcV)	22	18-24	22	18-24
No. of shock waves	2983	1800-3000	2915	1500-3000
Immediate success (%)*	77		77	
Caliceal stones				
Generator voltage (lcV)	22	18-24	22	18-24
No. of shock waves	2501	1500-3000	2552	1500-3000
Immediate success (%)	88		83	
Ureteral stones				
Generator voltage (lcV)	23	18-24	22	18-24
No. of shock waves	2652	1000-3000	2673	1000-3000
Immediate success (%)	72		80	

*Good or very good fragmentation.

This first clinical study using refurbished electrodes showed similar effectiveness in stone destruction both experimentally and clinically. Problems such as ghost ignition, isolation meltdown, and cracking were not seen. Considering the relative costs of new and refurbished electrodes, a cost reduction of 30% to 40% can be obtained with recycled electrodes without impairing the quality of treatment. Thus, the idea of reducing costs by using refurbished electrodes is not utopian any more.

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Address reprint requests to:
R. Schlick, M.D.
Dept. of Urology
Hannover Medical School
Konstanty-Gutschow-Strasse 8
D-3000 Hannover, Germany