

- Applicator -

Interstitial Vaginal Needle Implantation in Gynecological Tumors :  
Design and Construction of Applicator

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**Purpose** : It is not a simple task to achieve the ideal isodose curve with a standard vaginal applicator or single plane needle implant in the paravaginal tissue when primary or recurrent gynecological neoplasms(cervical cancers, vaginal cancers and vulvar cancers) are treated as a boost following external beam radiotherapy. The authors introduce the development and construction of a simple, inexpensive, customized applicator for volume implant to maximize the radiation dose to the tumor while minimizing the dose to the rectum and the bladder.

**Materials and Methods** : Nine patients underwent Ir-192 transperineal interstitial implantation for either recurrent(5 cases) or primary(3 cases) cervical cancers or primary vaginal cancer(1 case) between August 1994 and February 1998 at Ajou university hospital. First 3 cases were performed with a single plane implant guided by digital palpation. Because of inadequate isodose coverage in the tumor volume in first 3 cases, we designed and constructed interstitial vaginal applicator for volume implant to improve tumor dose distribution and homogeneity while sparing the surrounding normal tissue. Our applicators consist of vaginal obturator and perineal template that made of the clear acrylamide and dental mold material(Provil ). The applicators were customized individually according to the tumor size and its location. Both HDR and LDR irradiation were given with these applicators accomodating 6 Fr needles(Microselectron, Nucletron). The pretreatment planning prior to actual implant was performed whenever possible.

**Results** : Needles can be inserted easily and evenly into the tumor volume through the holes of templates, requiring less efforts and time for the implant procedure. Our applicators made of materials available from

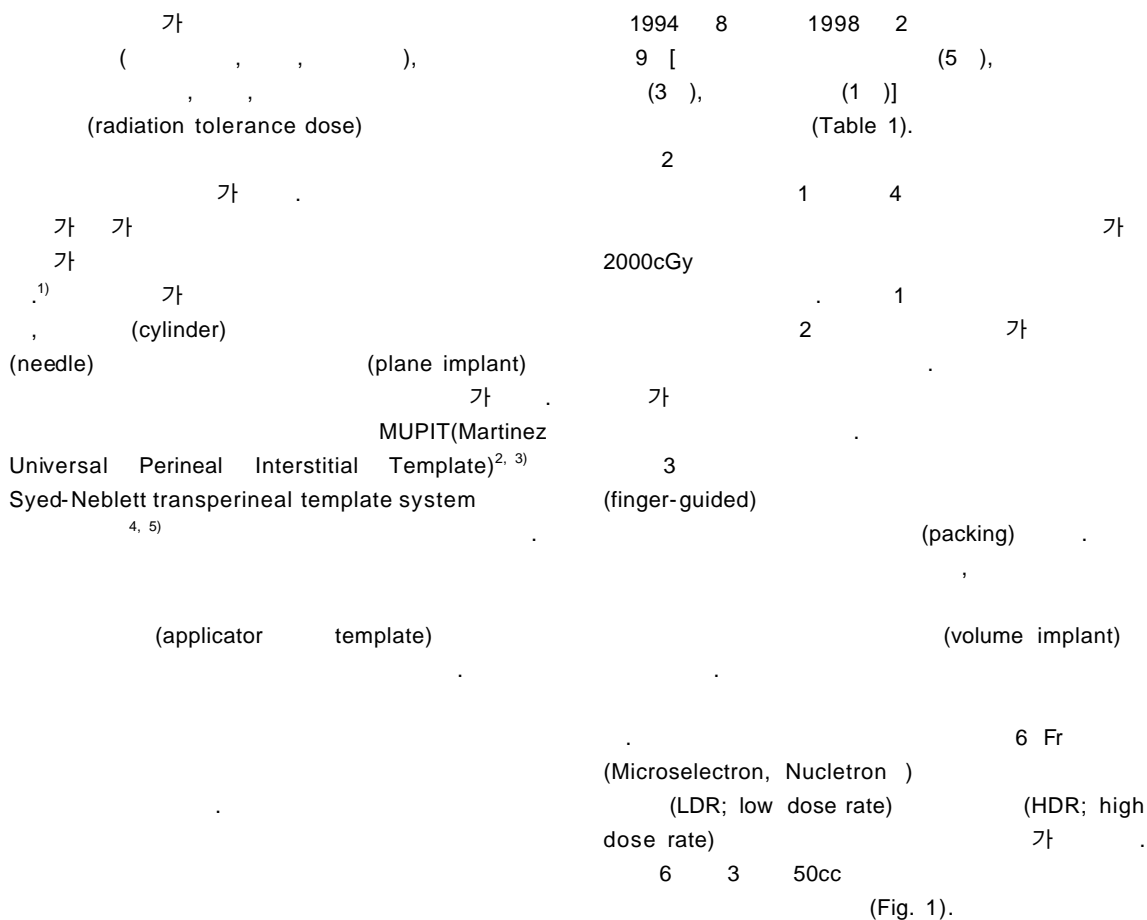
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commercial vendors. These have an advantage that require easy procedure, and spend relatively short time to construct. Also it was possible to fabricate applicators to individualize according to the tumor size and its location and to achieve the ideal isodose coverage. We found an accurate needle arrangement and ideal dose distribution through the CT scan that was obtained in 3 cases after needle implant. Three patients with primary cervical and vaginal cancers were controlled locally at final follow up. But all recurrent cases failed to do so.

**Conclusion** : The authors introduce inexpensive, simple interstitial vaginal templates which were self-designed and constructed using materials available from commercial vendors such as acrylamide and dental mold material(Provil ).

**Key Words** : Interstitial vaginal implant, Transperineal interstitial needle implant, Brachytherapy, Gynecological tumor, Applicator, Template



d) (mol 가 7 .  
 (Provil )  
 11cm, 7cm 가  
 (vaginal end) 3cm, (perineal end) 가  
 6cm 1cm 3  
 1.5cm

Table 1. Patient's Characteristics and Treatment

Age	Diagnosis (DFI)	Previous Treatment	Interstitial Brachytherapy (Ir-192)				F/U status
			Target Dimension (cm)	Catheter No./ Seeds No.	Total Dose (Gy)	Dose Rate (cGy/hr)	
63	Cervical cancer, 1st recurrence (3mo)	1. ERT & ICRT (78.4Gy) 2. ERT(50.4Gy) after recurrence	3 × 3 × 1 (periurethral area)	4/1	18 (3Gy/fx, bid)	HDR	outfield failure at 3mo lost to F/U
33	Cervical cancer, 2nd recurrence (3mo & 4mo)	1. CTx(× 3) & RH 2. ERT & vaginal mold (84Gy) after 1st recurrence 3. CTx(× 4) after 2nd recurrence	1 × 1 × 4 (Lt vaginal stump)	4/28	66	75	local failure at 4mo lost to F/U
72	Cervical cancer, 2nd recurrence (4mo & 21mo)	1. ERT & ICRT(75Gy) 2. RH & vaginal mold (40Gy/8fx) after 1st recurrence	4 × 4 × 4 (Lt vaginal stump)	8/53	55.2	60	NED at 8mo R/O vesicovaginal fistula at 8mo lost to F/U
70	Cervical cancer(Ib), residual tumor	1. ERT & ICRT(81Gy) 2. ERT to residual tumor(20Gy)	3 × 4 × 3	6/44	33.5	50	NED at 14mo
70	Vaginal cancer (I)	ERT to primary tumor (56.4Gy)	2 × 1.5 × 1	7/52	33	60	NED at 14mo
68	Cervical cancer, 1st recurrence (4mo)	1. ERT & vaginal cone therapy(73Gy) 2. ERT(54Gy) after recurrence	3 × 4 × 2 (suburethral orifice area)	7/50	31.5	50	near CR at 1mo lost to F/U
62	Cervical cancer, 1st recurrence (19mo)	1. ERT & ICRT (75.5Gy) 2. ERT(30Gy) after recurrence	4 × 2. 5 × 6.5 (upper ant. vaginal wall)	7/35	37	90	progressive disease
75	Cervical cancer (Ib)	ERT & ICRT(53Gy)	4 × 3 × 3	10/30	19.2	80	NED at 8mo
39	Cervical cancer(Ib1), residual tumor	1. disease progression after CTx(× 3) 2. ERT & ICRT(89Gy) 3. ERT to residual tumor(20Gy) cCTx	3 × 3 × 2	7/30	32	40	PR at 1mo

DFI; disease free interval, ERT; external radiation therapy, ICRT; intracavitary radiotherapy, RH; radical hysterectomy, CTx; chemotherapy, NED; no evidence of disease, CR; complete remission(complete disappearance of tumor), PR; partial response(reduction of >50% of tumor volume)

2  
 (acrylamide)  
 10cm( 8cm),  
 3cm, 4.5cm  
 (Fig. 2).  
 , Provil )  
 1.5cm 13 1cm 1  
 가  
 (Fig. 3).  
 가 mold

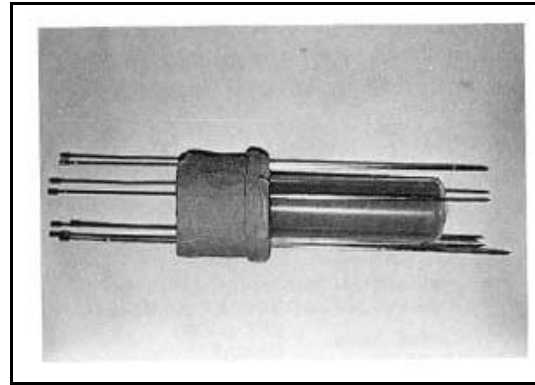


Fig. 1. First type of customized vaginal applicator.

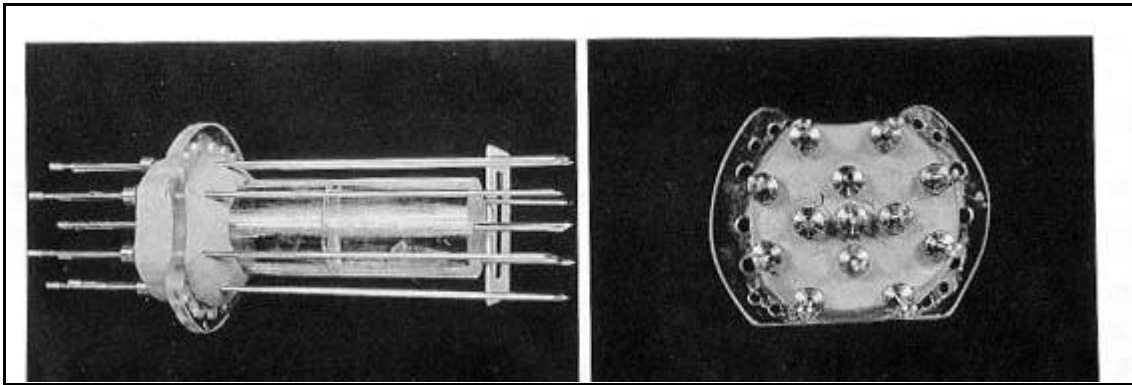


Fig. 2. Second type of customized vaginal applicator.

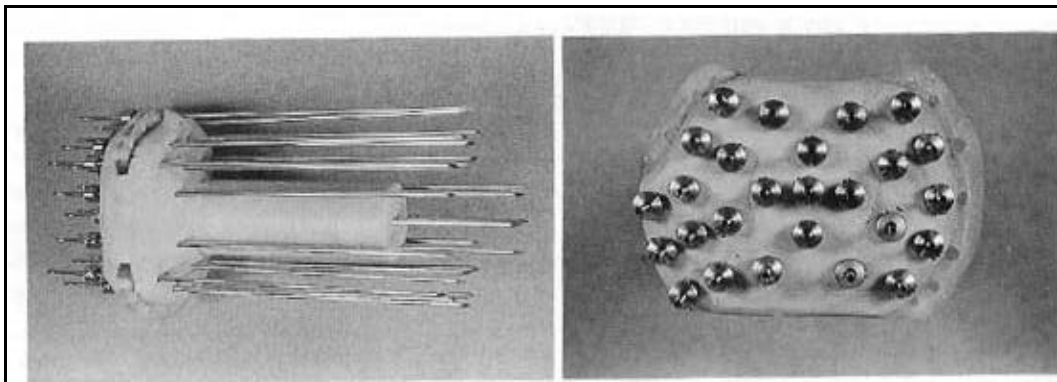


Fig. 3. Third type of vaginal applicator.

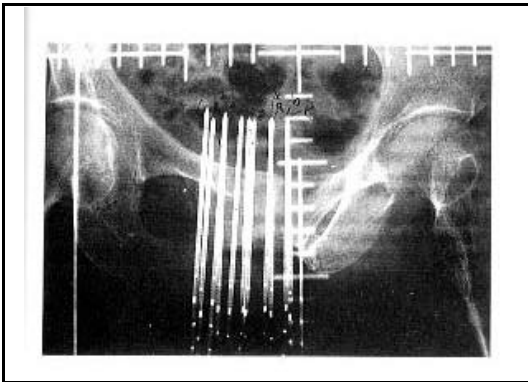


Fig. 4. Accurate arrangement of needles in simulation film.

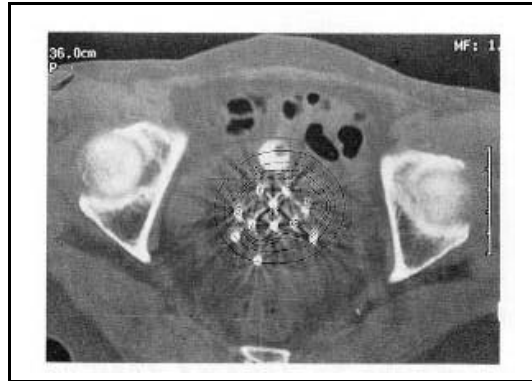


Fig. 5. Isodose distributions superimposed CT scan.

Paris  
 가  
 (iridium)-192  
 50-70cGy/hour (treatment prescription dose rate reference isodose)  
 20-66Gy(HDR; 18Gy, 3Gy/fx, bid)

. 3  
 가  
 (Fig. 5).  
 (button)

1-22 가 Table 1  
 가  
 19  
 5  
 mold ) ( , , ,  
 가  
 가  
 (Fig. 4).  
 30  
 가  
 (urethra) 가 가

(Flechter-Suit applicator, Henschke type applicator tandem ovoid tandem cylinder, Bloedorn Delclos vaginal cylinder) <sup>6-9)</sup>	Leung 7mm (homogeneity)	1990 methyl methacrylate	<sup>12)</sup>
가		가	
가 <sup>1)</sup>		가	
가 (shallow depth)	Martinez ( ) 8 (9%)	MUPIT 78 3 (3.8%)	-6.7 <sup>3)</sup> Ampuero
Bertoni arginate-powder (vaginal mold) depth) 1-2cm	Syed-Neblett <sup>13)</sup> 4cm 33%, 42%(12 ) 70-87%, <sup>1)</sup>	가 25-51 39% 40-75%	59%,
disease) 1930 (radium) <sup>11)</sup> (afterloader) 가 1974 Feder가 -192 가 1978 <sup>4)</sup>	가	가 ( - , - , )	
Syed-Neblett acrylic perineal plate (trochar) 1980 <sup>5)</sup>	가	tandem obturator "hot spot"	(activity) 가
MUPIT가 multiple-site, single-template interstitial-intracavitary applicator <sup>2, 3)</sup>	(dosimetry) 3-16%		8-42% <sup>1)</sup>
MUPIT (lower lying rectal cancer), (cesium tube) (ribbon) (interstitial-intracavitary applicator)	Syed <sup>14)</sup> (laparotomy) (1) (2) (3)	(bowel adhesion) adhesiolysis, (4) (5)	1975
Syed-Neblett Paterson-Parker Paris	MUPIT Manchester	omental pedicle graft <sup>1)</sup>	
perineal template technique			

open implant technique<sup>15, 16)</sup>

Monk  
28

28 71%, 36%  
<sup>17)</sup> 가 1  
(pelvic sidewall involvement),  
가 6cm , open interstitial implant  
가  
(dose intensity)  
Syed-Neblett<sup>18)</sup>, MUPIT<sup>19, 20)</sup>  
plastic tube technique  
<sup>21-24)</sup>

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: ( , , ) 가  
 , (cylinder) (needle)  
 (single plane implant) 가

· (volume implant) 가 (applicator

template) ,

: 1994 8 1998 2 9  
 (1 ) . 3 (5 ), (3 ),

· (LDR) (HDR) (Microselectron, Nucletron)  
 가 . 6 3 50cc  
 (1 ).  
 가

가 . 3

(2 ) . (mold) (Provil )  
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