



-RXUQDO RI 2GRQWRORJI

5HVHDFK \$UWLFQH

2SHQ \$F

&GGFDU PG /)FYZM \$ZBOPBDSZMBUF \$BMDJVN 5XP \$BMDJVN 4JMJDBUF #BTFE 3FTUPSBUIJWF \$

UHJ 6LOYD-\$ñ 6HUQDm 0X -Rj & &DVLā -LUR GH \$QGUD'GH -' 3LQK R)HUUHLUD \$ 2UWLJ 5XLJ \$-
'HSDUPHQW RI ,QWHJUDO 3HGLEDWULF 'HQVWLWUWH)DFXOW\ RI 0HG°LFLQH/ 8Q&YHUUVLWz FI 0000FLD RVS
6SDLQ

2UWKRRGRWLF 'HSDUWPHQW)DFXOGDGH GH 0HGLFLQD 'HQW ULD 8QLYHUVLW\ RI 3RUWR

&RUUHVSRRQLQ & DUXMKRLOYD \$)DFXOW\ RI 0HGLFLQH 'HSDUWPHQW RI ,QWHJUDO 3HGLEDWULF 'HQVWLWUWH
(PDIDPSDUR SHUHJ#XP HV

5HFHLYHGS WHPEHU \$FFHSWHGS WHPEHU 3XEOLVKHGS WHPEHU

&RSULJKW & UHJ 6LOYD \$ HW DO 7KLV LV DQ RSHQ DFFHVV DUWLFLDPRQVWULIEEXWLRO XQGHQVMKIZWLFHXP
XVH GLVWULEXWLRO DQG UHSURGXFWLRO LQ DQ\ PHGLXP SURYLGHG WKH RULJLQDO DXWKRU DQG VRXU

\$EVWUDFW

2EMHFWLYH REMHFWLYH RI WKLW VWXG\ ZDV WR HYDOXDWH WKH KLVWRORJLFDO
SODFHG RQ WKH GHQWDO SXOS

0HWKRGH XVHG IHPDOH :LVWDU UDWV SHU JURXS 7KH SXOS FKDPEHU URR
PRODUV ZDV SHUIRUDWHG \$IWHU FRQWURO RI EOHHGLQ\$07\$ P,LDERQG/ D SXOS F
&DOFLSDVW , RQ %ZDRGSHQDFLQH \$IWHU GDIV RI WUHDWPHQW WKH PRODUV ZHUH
PLFURVFRSH

5HVXOWR 5R7W \$SURGXFHG QR LQIODPPDWLRO RI DQ\ SXOS S :LWK &DOFL
DEVHQW RQO\ LQ RI WKH SXOSV \$OO VDP SOHV LQ DQ 007\$ URIDRER GGHVHQWHG S
DQG %LRGHQWRSN VKRZHG D GHQWLQ EULGJH DQG UHSDU\$07\$ WKLWKZHQWLDQ LQ DOO
FRPSOHWHO\ UHJXODU RGRQWREODVLF %LDREHGHQDFWHGIDRQGUHJXODU RGRQW
OD\HU LQ DOO SXOSV S O DQG &DOFLSDVW ,VKRZHG UHJXODU DQG LUU
3UR5RRW \$ S ZLWK &DOFLSDVW , DQG RQO\ RE DQGRVH WUHDWH
&DOFLSDVW VKRZHG ILEURVLV ,Q DOO JURXS V FDOFLILFDWLROV DSSHDUH
S

&RQFOXVLRQ KRXJK \$07\$ 5R7W WKH EHVW SHUIRUPDQFH WKH UHVSRRVH RI WKH S
PDWHULDOV XVHG ZDV VLPLODU DFFRUGLQJ WR WKH KLVWRORJLFDO FULWHULD R
UHJXODULW\ RU LUUHJXODULW\ RI WKH RGRQWREODVLF OD\HU GLG QRW LQIOXHQ

.HIZRUGV%LRGHQWLQH 0LQHUDO DJJUH&DWFILXW KLQDL\$IGKHDXWUD GLWLRODOO\ I
FIDQRDFU\ODWH &DOFLXP K\GUR[LGH \$00X EGRURUPQVLDQO USXOSDWKHUDS DV V
3XOS FDSSLQJ 3XOSRWRP\ PDQDJPHQW RI H[SRVHG GHQWDO SXOS

&OLQFLDQ }FDQFH

3UR5RRWp07\$,IDERQG' &DOFLSDVW , RU %LRGHQWLQH' FDO EH XVHG RQ
GHQWDO SXOS LQ YLWDO SXOS WKHUDS\ 1 KH\O FIDQRDFU\ODWH LV DQ DGKHLVLY

,QWURGXFWLRO

H QHGH WR SUHVHUYH WKH GHFLGX&XVSDQ SURPHQWLRO PLWD SXOSRWRP WRV
DYRLG RUWKRRGRQVWVSHREDSHPUDQFH &LRGHQWLQH\$XOSZ PDWHULDO EDVHG RQ F
'HUDS\937 H WHFKQLTXHV LW HQFRPSDUYHSHUWHGVLFDQ\$XOSRQ KDVHDHVVLPX
SURWHFWLRO LQ SHUPDQHQW WHHWK \$00\$XOSRWRP\ DQG \$00\$RWRP\ DWKRRUP
SHUPDQHQW WHHWK ,Q DOO WKHVH WHFKQLTXHVWKH SXOSRXYLW VLP SHUPDWR
DEOH WR KHDO DQG UHDFW WRHWKH FSHODFRPHQW RID PDWHULDO > @
IDLOXUH RI 937 GSHQGV RQ DQ H[DFW&Q-LQ-FDQV VYFWKYVDEVA07HVRFRQLV
LQIHFWLRO DQGDPRQWKIRQDEVHQFH RI WRRWLWQ RWKXW DUFK ZLWKRXW VREDO LVW
PDWHULDO XVHG DQGRVHDEWHQEB RUDFRFLV SURGXFWLRO RORJLFDOO\ WKH DEVHQ
IURP WKH H[WHULRU WR WKH SXOS FDEYLRW DQ DQGRVHDEWHQEB RUDFRFLV SURGXFWLRO RORJLFDOO\ WKH DEVHQ

&LWDWBRW] 6LOYD \$ 6HUQD 0X R] & &DV4PLUR GH \$QGUDGH -' 3LQK R)HUUHLUD \$ 2UW
 +\GUR\LGH 30XV ,RGRIRUP DQG 7ZR &DOFLXP 6LOLFDWH %DVHG 5HVWRUDWLYH &HPH

3DJH RI

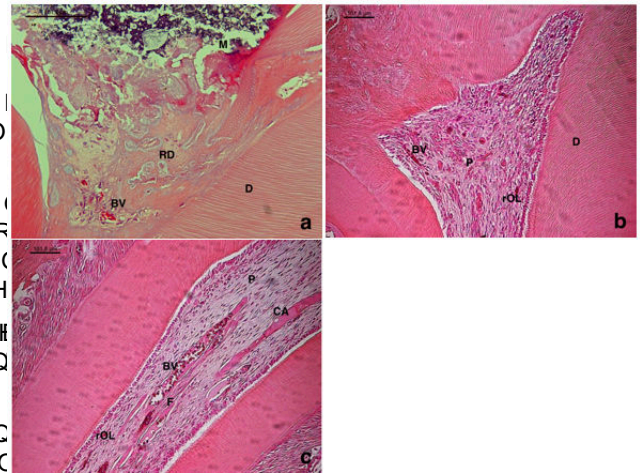
XVHG FDXVHG SXOSDO QHFURVLV DQG DOO SXOSV ZHUH YLWDO 7DEOH DQG)LJXUHV a

,Q WKH &DOFLSDVW , JURXS WKHUH Z GHQWLQ LQ RI VDP SOHV S G LQ DOO VDP SOHV RI WKH RWKHU WKUHI 07\$ KDG D UHJXODU RGRQWREODVWLF O DQG)LJXUHV a

&DOFLSDVW , SURGXFHG D UHJXODU R DQG LUUHJXODU WREODVWLF OD\HU R ,IDERQG' DQG %LRGHQWLQH' JHQHUDWH(DOO FDVHV S 7DEOH DQG)LJXUHV

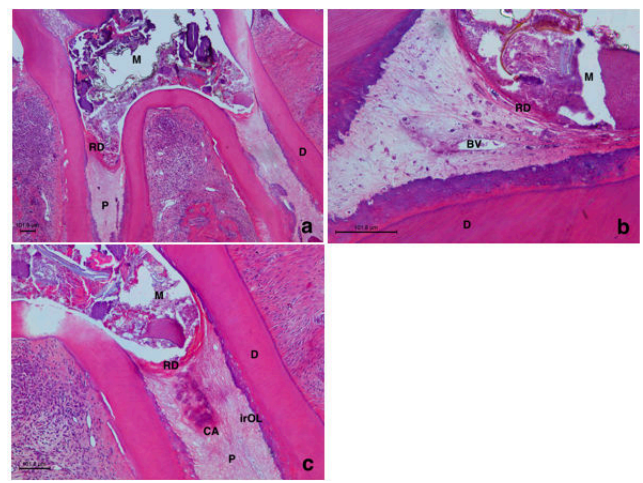
\$OO SXOSV WUHDWHG ZLWK 07\$ SURPSH ZLWK RI SXOSV WUHDWHG ZLWK 07\$ 7DEOH DQG)LJXUHV a

&DOFL}FDVSRDWHG LQ DOO JURXSV LQ EULGJH &DOFL}FDVSRDWHG LQ DOO , VDP SOH DQG ' DQG ,IDERQSOHV 7DEOH DQG)LJXUHV a



)LJXUHLVWRORJLFDQ REVHUYDWLRQ RI 07 DEVHQE-BPPDFRLOV SHUIRUDVW BXEXC UHSDUDWLYH GHQWLQ LQ FRQWDFW ZLW REVHUYHG DQ RGRQWREODVWLF OD\HU FDOFL}FDVSRDWH GHQWDO SXOS 1RWH 0 5HSDUDWLYH 'HQWLQ U2/ UHJXODU 2G LUUHJXODU 2GRQWREODVWLF W\REURV&\$ 'HQWDO 3XOS %9 %ORRG 9HVHVOV ' 'HQ

+LVWROR JLFDO 'HJUHH FULWHULD	UR5RRW\$07\$	IDERQ&DOFLS DMRGHQWLQH	&DOFLS	DMRGHQWLQH
	1RQH			
	6OLJKW			
'HJUHH RI LQIODPP DWLRQ	DRGHU DWH	D		D
	6HYHDH	D	D	D
	1HFURVLV	D	D	D
9LWDO SXOS	1R <HV	D	D	D
'HQWLQ 1R EULGJH DQG UHSDUDWLYH H GHQWLQ		D		D
	1R	D	D	D
2GRQWRE ODVWLFHJXODU OD\HU		D		D
	,UHHXODU			
)LEURVLV	1R <HV	D		
&DOFL}FDVSRDWH LQ WKH QRW UHODWHG WR EULGJH	D		D	



)LJXUHLVWRORJLFDQ REVHUYDWLRQ RI V JURXS PRVW FRPPRQ SDWWHUQ ZDV RI D RGRQWREODVW OD\HU DQG UHSDUDWLYH WKH SHUIRUDWLRQ RI LQKHPDPSORH SUHVJHQW DQG FDOFL}FDVSRDWH GHQWDO 1RWH 07\$ 0 ODWHULDO 5' 5HSDUDWLF 2GRQWREODVWLF /D\HU LU2/ LUUHJXODU &DOFL}FDVSRDWH 3 'HQWDO 3XOS % 'HQWLQ

7DEOHLVWRORJLFDQ HYDOXDWLRQ RI WKH SXOSDO UHVSQRVH

