

(IIHF W RI +HD Y\ OH WEDRO&SDVODN SWF L O O X V

9LMD\DGHDQGDVW36

5HVHDUFK 6FKRODU 'HSDUWPHQW RI 0LFURELRORJ\ 0DKDUDQL /DNVKPL \$PPDQQL &ROOHJH IRU :RPHQ 6
+2' 'HSDUWPHQW RI %RWDQ\ 0LFURELRORJ\ 9LMD\D &ROOHJH %DQJDORUH ,QGLD
&RUUHVSRRQGLQJL DWDKGHHS & 5HVHDUFK 6FKRODU 'HSDUWPHQW RI 0LFURELRORJ\ 0DKDUDQL /DNVKPL
%DQJDORUH %DQJDORUH 8QLYHUVLW\ YLQGLDDGHHS #JPDLDEQP

5HF GDWH 0D\ \$FF GDWH -XO 3XE GDWH -XO

&RS\ULJKW 9LMD\DGHH & HW DO 7KLV LV DQ RSHQ DFFHVV DUWLFOH GLVWULEXWHG XQGHU WKH W
XQUHVWULFWHG XVH GLVWULEXWLRQ DQG UHSURGXFWLRQ LQ DQ\ PHGLXP SURYLGHG WKH RULJLQDO D

\$EVWUDFW

2YHWKSHDVW FHQWXU\ XQUHVWULFWHG PLQLQJ H[WHQVLYH LQGXXWULDOL]DWLR
ZDVWH GLVSRVDO PHWKRGV KDYH UHVXOWHG LQ WKH UHOHDVH RI XQSUHFHGHQW
6Q 3E &X &R 0Q =Q HWF LQWR WKH HQYLURQPHQW 0DQ\ PHWDOV DUH HV
FRQFHQWUDWLRQ \HW DUH WR[LF LQ KLJKHU FRQFHQWUDWLRQV %LVRVRUSWLRQ L
WKH ELQGLQJ RU DGVRUSWLRQ RI KHDY\ PHWDOV WR OLYLQJ RU GHG FHOOV O
DFFXPXODWH PHWDOV

7KH SUHVHQW VWXG\ LV LQWHQGHG WR DQDO\ IHW FRQHQDIX\ WDNHGLIVHNUMLQHW FRRIQ%D
KHDY\ PHWDOV OLNH =Q &X &G DQG +J LQ WKHLU VDOW IRUP LQFRUSRUDWHG L
UHJXODU LQWHUYDO RI WLPH \$QDO\VLV ZDV EDVHG RQ KRZ PFK R WKH PHWDO I
LQ WKH PHGLD DIWHU WKH UHVW EHLQJ XS WDNHQ E\ WKH RUJDQLVP 7KLV ZDV
UHSUHVHQWDWLRQ RI SHUFHQW XSVDNH RI KHDY\ PHWDO E\ WKH UHVSHFWLYH RU

7KH VWXG\ VKRZHG WKDW *UDPFRQHKREJUW\GVPRUQHNLHVLDQFH WR PHWDOV OLN
UHODWLYH FRPSDULVRQ ZLWK *UDP%DFHLQOXVQLSV\ZDVLNOH VAD FRQHQWLYH WR HIIHF
FROL

FHQWULIXJHG DW USP IRU PLQXWHV WR VHSDUDWH RXW WKH FHOO
PDVV DQG WKH EURWK PHGLXP 7KH FHOO PDVV ZDV GLVFDUGHG DQG WKH
VXSHUQDWDQW ZDV XVHG IRU WKH KHDY\ PHWDO DQDO\VLV 7KH DQDO\VLV ZDV
EDVHG RQ KRZ PXFK RI WKH PHWDO IURP WKH RULJLQDO FRQFHQWUDWLRQ XVHG
ZDV OHIW EHKLQG LQ WKH PHGLD DIWHU WKH UHVW EHLQJ DEVRUEHG DGVRUEHG
WKH RUJDQLVP 7KLV ZDV GRQH XVLQJ \$WRPLF \$EVRSWLRQ 6SHFWURVFRS\
\$\$6 ZKLFK ZDV LQGLUHFWO\ WKH UHSUHVHQWDWLRQ RI SHUFHQW XSVDNH RI
KHDY\ PHWDO E\ WKH UHVSHFWLYH RUJDQLVP 7KH UHVXOWV RI SHUFHQW XSVDN
RI KHDY\ PHWDO ZDV FDOFXODWHG DQG WDEXODWHG

5HVXOWV

,Q FDVH RI LQLWLDO VFUHHQLQJ SURFHGXUHV ZLWK SSP FRQFHQWUDWLRQ
RI VHOHFWHG %KOHFDWLSOPXNW\RDZHG JRRG JURZWK ZLWK SSP
DQG SSP RI =Q DQG SSP RI & X :LWK LQFUHDVH LQ WKH FRQFHQWUDWLRQ
WKH JURZWK ORQXV



*UDSK DEV RUS WLRQF & QSD FEAVSOA/X V

'LVFXVVLRQ

,W LV FOHDU IURP WFRQKLBZB NQ OJWVR GV KDFEWRUSWLRQ
 DGVRUSWLRQ SRWHQWLDO ZLWK WKUHH RI WKH IRXU KHDY\ PHWDOV XVHG LQ W
 VWXG\ WKDW LV ZLWK =Q & X DQG +J *UDSKV DQG UHVSHFWLYHO\ ZKHQ
 FRPSDUWDFWDOXV%DFLOOXV RQ WKH RWKHU KDQG VKRZHG D EHWWHU
 WROHUDQFH DQG XSVDNH ZLWK &G *UDSK 6LPLODU ILQGLQJV ZHUH
 UHSRUWHG ZLWK UHVSHFW WR &G ELRVVRUSWLRQ VWXGLHV > @ ,W ZDV DOVR
 UHSRUWHG WKDW PHWDOF RQDQG UQJO DWSDFHOLWKLHV KRHIU
 WKDFQFLDQXV@ 'LIIHUUHQW PLFURELDO VRXUFHV OLNH WKH JUHHQ DOJDH
 &ORVWPHRQQLXPLPHRQXP HKUHQE > @ DQG VHYHUDO IXQJL > @ DUH
 LQGHHG JRRG ELRVVRUEHQWV OLNH EDFWHULD ,W ZDV UHSRUWHG HDUOLHU LQFUI
 PHWDO XSVDNH E\ EDFWHULD OHG WR WKHLU GHDWK E\ YDULRXV FHOV PHGLDW
 PHFKDQLVPV > @ 7KH DERYH VDLG PHFKDQLVPV FRXOG KDYH EHHQ WUXH LQ
 WKH SUHVHQW VWXG\ VLQFH WKH GHDWK UDWH RI WKH EDFWHULD FHOOV Z
 REVHUYHG WR EH LQFUHDVLQJ ZLWK WKH LQFUHDVLQJ FRQF RI PHWDO WDNHQ L
 WKH FHOOV

,Q FRQFOXVLRQ WKH SUHVHQW VWXG\ KLJKOLJKWV WKH PLFUREHV SRVVHVV D
 KLJK SRWHQWLDO IRU PHWDO UPHGGLDWLRQ VWUDWHJLHV DQG FDQ PLQLPLJH W

ELRDYDLODELOLW\ DQG ELRWR[LFLW\ RI KI
 OLNHFRAO\H SURYHG WR EH JRRG ELRVVRUE
 DQG +J ZKLOH %DFLOOXV FDQ EH D ELR
 WR[LFLW\ 7KHVH RUJDQLVPV FDQ EH H[SO
 ELRUUHPHGLDO SXUSRVHV

\$FNQRZOHGJHPHQWV

, JUDWHIXOO\ DFNQRZOHGJH WKH DVVLV
 %RWDQ\ OLFURELRORJ\ DQG %LRWHFKQRC
 DOVR WKDQN 6KDVKLUHNKD &KLHI &KHP
 0LQHV *RYHUQPHQW RI .DUQDWND %DQJ
 \$QDO\VW 6KXNOD % 3 =RQDO 2IILFHU &H
 %DQJDORUH IRU WKHLU UHJDUGIXO DVVLV

5HIHUhQFHv

*DGG0 +HDY\ PHWDO DFFXPXODWLRQ
 PLFURRUJDQLVPV ([SHULHQWLD
 *RXUGRQ%KHQGH 6 5XV (6RIHU 66 &R