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2009년 2월

석사학위논문

Increasing the width of attached
gingiva using the collagen wound
dressing

조 선 대 학 교 대 학 원

치 의 학 과

나 인 채

Increasing the width of attached
gingiva using the collagen wound
dressing

교원질 향상 드레싱을 사용한 부착치은의 증대

2009년 2월 25일

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Increasing the width of attached
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Contents

LIST OF TABLE

LIST OF FIGURES

ABSTRACT	iv
I. Introduction	1
II. Materials and methods	4
III. Results	7
IV. Discussion	8
V. Conclusion	10
References	11

ABSTRACT IN KOREAN

List of Table

Table 1. Surgical areas in six dogs	18
Table 2. Clinical parameters (mm) at Baseline and Post-surgery	19
Table 3. Comparison of Post-surgery clinical parameters (mm)	19

List of Figures

Fig. 1. Apically repositioned flap. Recipient bed preparation	20
Fig. 2. Free gingival graft harvesting from palate	20
Fig. 3. Horizontal key suture to fix the graft on recipient bed	21
Fig. 4. Twofold collagen wound dressing (Collatape®) Similar thickness with gingival graft	21
Fig. 5. Horizontal key suture to fix Collatape® on recipient bed	22
Fig. 6. APF only group (6 weeks after surgery)	22
Fig. 7. APF combined with FGG group (6weeks after surgery)	23
Fig. 8. APF combined with Collatape® (6 weeks after surgery)	23

ABSTRACT

Increasing the width of attached gingiva using the
collagen wound dressing

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An adequate band of keratinized tissue was viewed as important to prevent future recession and maintain periodontal health. The purpose of this study was to evaluate the width of attached gingiva after apically repositioned flap (APF), APF combined with free gingival grafts(FGG), and APF combined with collagen wound dressing(Collatape[®], Zimmer Dental, California, USA) coverage.

6 mongrel dogs, right and left maxillary canine areas were used (12 surgical sites). First, only APF procedure was performed. Second, APF combined with free gingival grafts(FGG) was performed. Third, APF combined with Collatape[®] coverage was performed.

After 6 weeks, the results were observed. The measurement value was probing depth(PD), width of keratinized gingiva(KG), and width of attached gingiva(AG). The comparison between 3 surgical procedures showed that the width of keratinized and attached gingiva increased clinically. The comparison of the widths of the keratinized and

attached gingiva before and after surgery showed that the differences were significant in each group($P < 0.05$). APF combined with FGG areas showed more attached gingiva increment and favorable physiological appearance than other surgical procedures(No significant difference between groups in attached gingiva increment). APF combined with Collatape[®] coverage areas showed similar attached gingiva increment with APF only areas. And as if APF combined with FGG areas, APF combined with Collatape[®] coverage areas also showed favorable physiologic appearance than APF only areas.

APF combined with Collatape[®] coverage was useful procedure to increase the keratinized gingiva and attached gingiva.

I. Introduction

The attached gingiva is composed of keratinized epithelium, dense connective tissue, and periosteum and plays an important role in the protection of the periodontal structures¹⁾. For many years, the presence of an "adequate" amount of keratinized gingiva was considered a keystone for the maintenance of periodontal health^{2),3),4)}. Lang and Loe⁵⁾ reported that despite the fact that the tooth surfaces were free from plaque, "all surfaces with less than 2.0mm of keratinized gingiva exhibited clinical inflammation and varying amounts of gingival exudates." The attached gingiva provides increased resistance of the periodontium to external injury, contributes to the stabilization of the gingival margin position, and aids in the dissipation of physiological forces that are exerted by the muscular fibers of the alveolar mucosa onto the gingival tissues^{6),7),8)}. But other investigators^{9),10),11)} failed to find a similar association and reported that it is possible to maintain healthy marginal tissues, even in areas with a reduced or missing keratinized gingiva. However, Valderhaug and Birkeland¹²⁾ reported that subgingival placement of restorations was associated with a significantly higher rate of gingival inflammation, attachment loss, and gingival recession over 10 years. In addition there was a significant association between subgingival restorations and gingival inflammation in areas with minimal keratinized gingiva in patients with less than optimal plaque control¹³⁾.

An the presence of site-related conditions, e.g., gingival recession, thin periodontium, and root prominence, combined with a reduced or missing amount of attached gingiva, may indicate a gingival augmentation procedure. Serino et al.¹⁴⁾ showed that sites with gingival

recession should be considered susceptible to additional apical displacement of the soft tissue margin. The American Academy of Periodontology¹⁵⁾ suggested several indications for gingival augmentation procedures: to prevent soft tissue damage in the presence of alveolar bone dehiscence during natural or orthodontic tooth eruption; to halt progressive marginal gingival recession; to improve plaque control and patient comfort around teeth and implants; and to increase the insufficient dimension of gingiva in conjunction with fixed or removable prosthetic dentistry.

Since Friedman¹⁶⁾ introduced the term mucogingival surgery in the 1950s, various procedures have been used to correct problems associated with the lack of attached gingiva. One of the first surgical techniques designed to correct such problems was an apically positioned flap^{17),18)}. This technique allowed surgeons to increase or preserve the area of attached gingiva by moving the tissue apically and exposing a variable band of crestal bone, depending on how much attached gingiva was desired¹⁸⁾. Another technique to increase attached gingiva was free epithelialized palatal gingiva graft¹⁹⁾. The availability to obtain adequate donor tissue and ability to treat multiple teeth were two of the advantages of this technique; its disadvantages include technical difficulty, postoperative discomfort, and poor color match.

Recently, many of the disadvantage of the classic procedure have been overcome by modification of procedure and use of tissue engineering materials¹⁸⁾. Collagen wound dressing have been used for control of bleeding and stabilization of blood clots, and protection of wound bed.

The purpose of this article was to evaluate the width of attached gingiva after apically repositioned flap (APF), APF combined with free

gingival grafts(FGG), and APF combined with collagen wound dressing coverage(Collatape[®] , Zimmer Dental, California, USA).

II. Materials and methods

1. Surgical procedure

Six mongrel dogs about 1 year old and weighing about 17–19 kg each were used for this experiment. Supragingival scaling was performed on all dogs before surgery. Anesthesia was induced by injection of tiletamine-zolazepam (Zoletil 50[®], Virbac, Carros, France – 5–10mg/kg, intramuscular) and xyalazine HCL (Rompun[®], Bayer, Korea – 0.15ml/kg, intramuscular).

In both quadrants of the maxilla the canine area were used as experimental sites. Three different surgical technique was performed onto twelve canine areas(Table 1):

First, only apically repositioned flap was performed. APF were performed according to the modified technique described by Carnio et al¹⁸⁾. Before the incisions were made, the level of crestal bone was probed to detect the presence of any bone dehiscence. A periodontal probe or anesthetic needle may be used via gingival sulcus. A horizontal beveled incision was made in the attached portion of the keratinized gingiva slightly apical to the alveolar crest. The mesial and distal extensions of the initial horizontal incision were made(20mm). Two vertical incisions were placed on the mesial and distal ends connecting the horizontal incision(20mm). These incisions extended beyond the mucogingival junction. A split-thickness flap was elevated, moved apically, positioned at the desired level, and fixed by periosteal horizontal suture wirh resorbable suture materials(Monosyn[®] 5-0, B. BRAUN Melsungen AG, USA). The size of exposed periosteal bed was 20mm x 20mm(Fig. 1).

Second, APF combined with free gingival grafts was performed.

APF procedure was performed same as first method. Free gingiva graft was harvested from palate, trimmed and shaped to fit the recipient site(Fig. 2). The thickness of graft was about 1.5mm. And the graft was fixed onto periosteal bed with horizontal key suture(Fig. 3). Pressure was applied to the recipient site after suturing to ensure hemostasis and tissue adaptation for 3 min.

Third, APF combined with collagen wound dressing (Collatape[®], Zimmer Dental, California, USA) coverage was performed. Twofold Collatape[®] was used for same thickness as FGG. After preparation of recipient site, Collatape[®] was trimmed and shaped to fit the recipient site(Fig. 4). And Collatape[®] was fixed same as FGG method(Fig. 5). Pressure was also applied for 3 min.

2. Postsurgical care

Following surgery, each dog received an injection of antibacterial agent(Gentamicin 0.1ml/kg, Daesung, Korea) for seven days. Tooth cleaning with 0.2% chlorhexidindigluconat was performed three times per week for 4 weeks.

The sutures were removed two weeks after surgery. Healing presented uneventful. The soft tissue graft were fully integrated without any sign of necrosis.

3. Clinical measurements

The index was marked on mid-buccal surface of canine, 3mm from gingival margin. Probing depth(PD) was measured at three points (mesio-buccal, mid-buccal, and disto-buccal) to the nearest millimeter with a probe(tip diameter: 0.45mm; probing force: 20gm/pressure). The PDs at three points were averaged for the purpose of analysis. The

width of keratinized gingiva(KG) at the mid-buccal point was measured from the mucogingival junction(MGJ) to the free gingival margin. The width of attached gingiva(AG) was calculated by subtracting PD at the mid-buccal point from the width of KG to the nearest millimeter.

4. Statistical analysis

A statistical software program(SPSS 16.0, SPSS Inc. USA) was used for all statistical analyses. The paired T-test was performed to analyze the differences between baseline and six weeks postsurgery. Analysis of variance(ANOVA) were performed to analyze the difference for the continuous clinical parameters between three surgical procedures. A value of $P < 0.05$ was considered as statistically significant.

III. Results

Pre- and postoperative clinical measurements are reported on Table 2. Treatment with three surgical procedures resulted in statistically significant augmentation of the apico-coronal dimension of the keratinized gingiva and attached gingiva ($P < 0.05$) (Fig. 6, 7, and 8).

In APF areas, the mean apico-coronal dimension of the keratinized gingiva was 12.85mm (range, 7.2mm to 16.7mm) preoperatively and 20.40mm (range, 17.0mm to 21.9mm) postoperatively. The mean apico-coronal dimension of the attached gingiva was 11.22mm (range, 5.4mm to 14.2mm) preoperatively and 18.80mm (range, 15.5mm to 20.4mm) postoperatively.

In APF combined FGG areas, the mean apico-coronal dimension of the keratinized gingiva was 14.30mm (range, 7.2mm to 16.7mm) preoperatively and 22.22mm (range, 13.1mm to 15.3mm) postoperatively. The mean apico-coronal dimension of the attached gingiva was 13.02mm (range, 11.9mm to 14.0mm) preoperatively and 20.97mm (range, 18.2mm to 25.2mm) postoperatively.

In APF combined Collatape[®] coverage areas, the mean apico-coronal dimension of the keratinized gingiva was 13.25mm (range, 10.8mm to 15.1mm) preoperatively and 20.42mm (range, 19.8mm to 21.5mm) postoperatively. The mean apico-coronal dimension of the attached gingiva was 11.65mm (range, 9.1mm to 13.5mm) preoperatively and 19.15mm (range, 18.3mm to 19.9mm) postoperatively.

No statistically significant difference in probing depth was detected pre- and postoperatively in each procedures.

No statistically significant differences could be assessed for each procedure (Table 3).

IV. Discussion

The main objective of this study was to evaluate the changes in the amount of attached gingiva following application of APF, APF combined FGG, and APF combined Collatape[®] coverage. The study showed that the amount of attached gingiva had increased six weeks after surgery in all procedures. However, there were some morphological differences between procedures. In APF areas, foldings and scar like tissues are observed at vestibule area(Fig. 6). It was believed the split-thickness flap moved to coronally during healing due to muscular movement of vestibule. In APF combined FGG areas, there were more attached gingiva increment and showed favorable physiological morphology than other groups(No significant difference between groups in amount of attached gingiva) (Fig. 7). In APF combined Collatape[®] coverage areas, there were similar amount of attached gingiva increment with only APF areas. But, as if APF combined with FGG areas, APF combined with Collatape[®] coverage areas also showed favorable physiologic morphology than only APF areas(Fig. 8). Collatape[®] controls bleeding and stabilized blood clots, and protects wound bed. And it is slowly absorbed during 10 to 14 days. But, if Collatape[®] is exposed directly to oral environment, it is absorbed more rapidly²⁰⁾. It was believed that Collatape[®] act as scaffold to disturb the apically positioned flap move to coronally, and protection of the recipient bed. So it is considered APF combined with Collatape[®] coverage areas showed favorable physiologic mophology. Further studies are needed for this.

Although the presence of keratinized gingiva or attached gingiva is not a critical factor in reducing bone loss, it appears to be

significantly advantageous in reduction of gingival inflammation and plaque accumulation²¹⁾. According to several reports, 2.0mm of attached gingiva is sufficient for the maintenance of periodontal health^{22,23)}, even in cases in which subgingival restoration margins are placed^{24,25)}. In this study, modified apically repositioned flap surgery performed to increase the attached gingiva¹⁸⁾. According to some authors,^{26,27,28)} the main determining factor of the nature of the new tissues that develop over the exposed periosteum rests with origin of the granulation cells that migrate over the wound. These cells migrate from the periosteal connective tissue, adjacent gingival and alveolar mucosa, periodontal ligament, and bone marrow spaces. The surgical wound created by APF is surrounded completely by keratinized tissue. This prevents non-keratinized epithelial cells originating from the oral mucosa from proliferating onto the surgical area¹⁸⁾. As a result, predictable increase in the apico-coronal gingival dimension came to possible. The results of this study are in agreement with those of previous studies^{17,18)}.

Augmentation of keratinized tissue width and vestibular deepening with autogenous free gingival grafts have been predictable and effective method^{30,31,32)}. Although the incidence of complications is very low, discomfort and pain at the donor site are frequently observed³¹⁾. The use of Collatape[®] eliminates the need of a secondary surgical site and provides an unlimited amount of donor tissue. However it is difficult to conclude whether well organized keratinized gingiva was created. Further histological studies are needed.

V. Conclusion

The APF, APF combined with FGG, and APF combined with Collatape[®] coverage showed successful increase of attached gingiva. APF combined with FGG, Collatape[®] coverage areas showed more smooth and physiologic attached gingiva formation than APF only areas. Further studies are necessary to determine the influence of Collatape[®] and various recipient bed preparations.

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ABSTRACT IN KOREAN

교원질 창상 드레싱을 사용한 부착치은의 증대

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적절한 두께의 각화치은은 향후의 치은 퇴축을 방지하고 치주조직의 건강을 유지하는데 중요하다고 여겨지고 있다. 이 연구의 목적은 근단 변위 판막술, 유리 치은 이식술을 동반한 근단 변위 판막술, 그리고 교원질 창상 드레싱(Collatape® · Zimmer Dental, California, USA) 피개를 동반한 근단 변위 판막술을 각각 시행한 경우 부착치은의 증가량을 평가하는 것이다.

6마리 잡종견의 상악 좌우측 견치부분을 실험에 사용하였다. 첫 번째는 근단 변위 판막술 만을 사용하였고, 두 번째는 유리 치은 이식술을 동반한 근단 변위 판막술을, 세 번째는 교원질 창상 드레싱 피개를 동반한 근단 변위 판막술을 시행하였다.

6주 후 결과를 관찰하였다. 치은열구 깊이, 각화치은의 너비, 그리고 부착치은의 너비를 각각 측정하였다. 3가지 술식의 각화치은과 부착치은의 너비를 비교한 결과 술 전 보다 모두 통계적으로 유의하게 증가하였다 ($P < 0.05$). 유리 치은 이식술을 동반한 근단 변위 판막술은 다른 술식들보다 더 많은 양의 부착치은의 증가와 생리적으로 더 양호한 형태의 치은 형성이 관찰되었다(부착치은의 증가량에 있어서는 다른 술식들과 유의한 차이는 없었다). 교원질 창상 드레싱 피개를 동반한 근단 변위 판막술은 부착치은의 확보량에 있어서는 근단 변위 판막술만 시행한 부위와 비교시 유사한 결과를 보였으나, 더 생리적으로 양호한 형태의 치은 형성이

관찰되었다.

교원질 향상 드레싱 피개를 동반한 근단 변위 판막술은 각화 치은과 부착치은의 양을 증가시키는 데 있어서 유용한 술식으로 생각된다.

Tables

Table 1. Surgical areas in six dogs

	Right Mx. canine	Left Mx. canine
Dog 1	APF	APF + FGG
Dog 2	APF + FGG	APF + Collatape [®]
Dog 3	APF + Collatape [®]	APF
Dog 4	APF	APF + FGG
Dog 5	APF + FGG	APF + Collatape [®]
Dog 6	APF + Collatape [®]	APF

APF; apically repositioned flap; FGG; free gingival graft

Table 2. Clinical parameters(mm) at Baseline and Post-surgery

Parameter	Baseline (mean \mp SD)	Post-Surgery (mean \mp SD)	P Value
PD			
APF only	1.625 \pm 0.3500	1.600 \pm 0.3742	0.718
APF + FGG	1.275 \pm 0.0957	1.250 \pm 0.1915	0.761
APF + Collatape [®]	1.475 \pm 0.2062	1.465 \pm 0.3202	0.741
Width of keratinized gingiva			
APF only	12.850 \pm 4.0485	20.400 \pm 2.2906	0.040
APF + FGG	14.300 \pm 1.1165	22.225 \pm 3.0999	0.025
APF + Collatape [®]	13.250 \pm 1.7746	20.425 \pm 0.7455	0.010
Width of attached gingiva			
APF only	11.225 \pm 4.1250	18.800 \pm 2.2316	0.042
APF + FGG	13.025 \pm 1.1325	20.975 \pm 3.1224	0.023
APF + Collatape [®]	11.650 \pm 1.8484	19.150 \pm 0.6608	0.009

APF; apically repositioned flap; FGG; free gingival graft

* SPSS 16.0, paired T-test

Table 3. Comparison of Post-surgery clinical parameters (mm)

Parameter	Post-surgery (mean \mp SD)			P Value
	APF only	APF + FGG	APF + Collatape [®]	
PD	1.600 \pm 0.3742	1.250 \pm 0.1915	1.275 \pm 0.3202	0.247
Width of keratinized gingiva	20.400 \pm 2.2906	22.225 \pm 3.0999	20.425 \pm 0.7455	0.458
Width of attached gingiva	18.800 \pm 2.2316	20.975 \pm 3.1224	19.150 \pm 0.6608	0.380

APF; apically repositioned flap; FGG; free gingival graft

* SPSS 16.0, one-way ANOVA

Figures

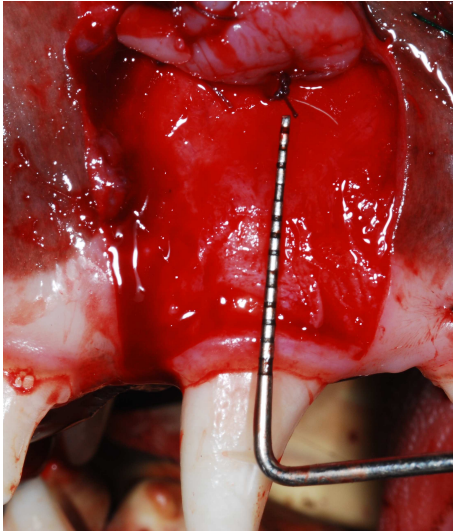


Fig. 1. Apically repositioned flap. Recipient bed preparation(20mm x 20mm)

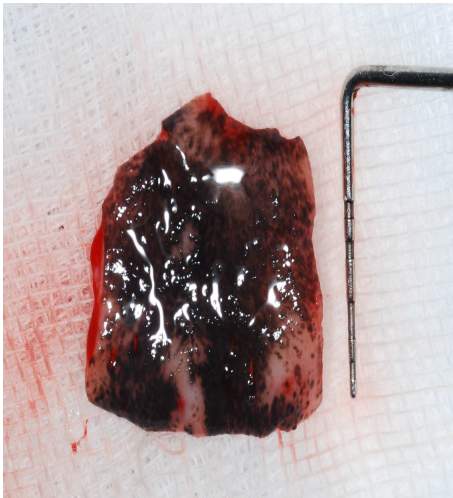


Fig. 2. Free gingival graft harvesting from palate (2cm x 2cm x 0.15cm)

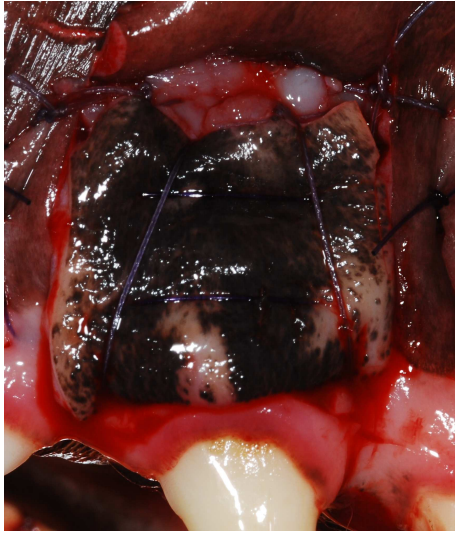


Fig. 3. Horizontal key suture to fix the graft on recipient bed

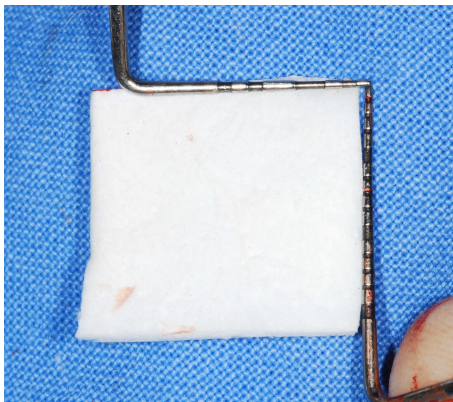


Fig. 4. Twofold collagen wound dressing (Collatape[®]) Similar thickness with gingival graft (2cm x 2cm x 0.15cm)

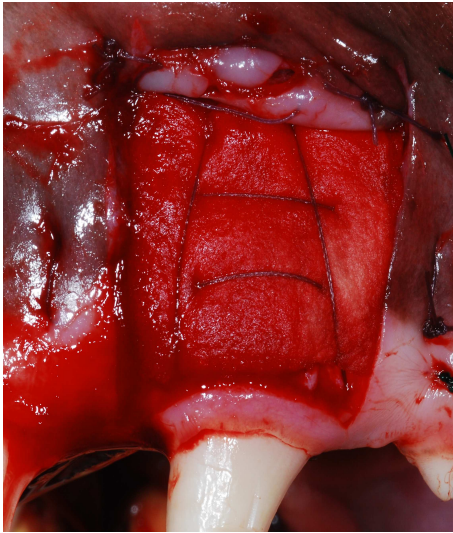


Fig. 5. Horizontal key suture to fix Collatape[®] on recipient bed

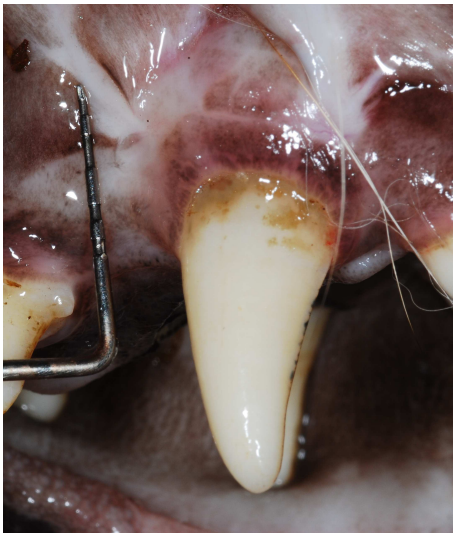


Fig. 6. APF only group (6 weeks after surgery). Foldings and scar like tissues are observed at vestibule area.



Fig. 7. APF combined with FGG group (6weeks after surgery).
Smooth and physiologic morphology of attached gingiva is observed.



Fig. 8. APF combined with Collatape® coverage(6 weeks after surgery)
Smooth and physiologic morphology of attached gingiva is observed.

저작물 이용 허락서

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논문제목	한글 : 교원질 향상 드레싱을 사용한 부착치은의 증대 영어 : Increasing the width of attached gingiva using the collagen wound dressing				

본인이 저작한 위의 저작물에 대하여 다음과 같은 조건아래 조선대학교가 저작물을 이용할 수 있도록 허락하고 동의합니다.

- 다 음 -

1. 저작물의 DB구축 및 인터넷을 포함한 정보통신망에의 공개를 위한 저작물의 복제, 기억장치에의 저장, 전송 등을 허락함
2. 위의 목적을 위하여 필요한 범위 내에서의 편집·형식상의 변경을 허락함.
다만, 저작물의 내용변경은 금지함.
3. 배포·전송된 저작물의 영리적 목적을 위한 복제, 저장, 전송 등은 금지함.
4. 저작물에 대한 이용기간은 5년으로 하고, 기간종료 3개월 이내에 별도의 의사 표시가 없을 경우에는 저작물의 이용기간을 계속 연장함.
5. 해당 저작물의 저작권을 타인에게 양도하거나 또는 출판을 허락을 하였을 경우에는 1개월 이내에 대학에 이를 통보함.
6. 조선대학교는 저작물의 이용허락 이후 해당 저작물로 인하여 발생하는 타인에 의한 권리 침해에 대하여 일체의 법적 책임을 지지 않음
7. 소속대학의 협정기관에 저작물의 제공 및 인터넷 등 정보통신망을 이용한 저작물의 전송·출력을 허락함.

동의여부 : 동의(○) 반대()

2009년 2월 일

저작자: 나 인 채 (서명 또는 인)

조선대학교 총장 귀하