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Periodontology

Crown Lengthening for Functional Rehabilitation Using Er: YAG Laser: A Case Series

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Abstract **Case Report**

Aim*:** To rehabilitate severely decayed teeth with inadequate clinical crown by surgical crown lengthening. ***Background*:** Crown lengthening is a surgical procedure aimed at increasing clinical crown length by removal of periodontal tissue. The dentist should have adequate knowledge of biological width, indications, technique, as well as its limitations. Taking into account biological factors crown lengthening as part of an overall treatment plan in a controlled and predictable manner can be carried out. In clinical practice, dentist faces dilemma in encountering patients with tooth wear. Providing fixed prosthesis becomes a challenge. ***Technique*:** Conventional methods employ scalpel blade and rotary instruments. Lasers have made impressive inroads into periodontal therapy. This case series discusses surgical crown lengthening of severely attrited teeth with Er: YAG laser for adequate prosthetic restoration. ***Conclusion*:** Er: YAG laser was effective in crown lengthening procedure with least discomfort to patients. Results achieved with Er: YAG laser was satisfactory and prosthetic rehabilitation was successful. ***Clinical Significance: Er: YAG laser is a boon in modern dentistry. It can handle soft tissues as well as hard tissues with ease. Surgical procedures done with laser are bloodless and painless. In comparison with scalpel blade where patient has anxiety undergoing surgery, use of laser negates all the apprehension. Results achieved with laser are promising and clinically successful.

Keywords: Crown lengthening, biologic width, osteoplasty, osteotectomy and Er: YAG.

INTRODUCTION

Positive outcome of fixed prosthesis on short clinical crowns mainly depends on how efficiently the biological width is preserved. The junctional epithelium and the connective tissue attachment together constitute what is known as biologic width [1]. Keeping the margins of prosthesis within this important zone encroaches on biologic width resulting in gingival inflammation, periodontal pocket formation and ultimately alveolar bone loss. Thus, periodontal intervention namely surgical crown lengthening is a must in dentition with short clinical crown. This surgical approach would provide a healthy zone above the alveolar crest, thereby preventing ingress on the biologic width. Traditional treatment comprises of using scalpel blade, curettes and rotary burs. In recent years use of lasers in dentistry has created a revolution. Erbium lasers like yttrium-aluminum-grant (Er: YAG) and erbium, chromium: yttrium-scandium-gallium-garnet (Er, Cr: YSGG) are being used in various clinical procedures. Laser photons emitted are absorbed well in both water and hydroxyapatite [2].

Soft and hard tissue forms integral part of periodontium, hence Er: YAG laser is the safest bet to perform various periodontal procedures. The advantages of Er: YAG laser outweighs the traditional approach. Safety, less pain experience, patient acceptance and non-administration of local anaesthesia to name a few [3].

In the year 2006, Syneron Medical in Israel developed the new Lite Touch Er: YAG dental laser. Here is a case series describing successful functional rehabilitation of short clinical crowns using Er: YAG laser.

CASE 1

A 19 year old female patient was referred for crown lengthening with respect to 36. Inadequate clinical crown was evident bucally and lingually in 36(Fig.1 & 2). Patient had undergone root canal treatment followed by post and core build up (Fig. 3). Gingival sulcus and width of attached gingiva was adequate. Patient was systemically healthy. Routine haematological investigation was carried out. The purpose of surgical crown lengthening is to achieve at least 3 to 4 mm of healthy tooth structure coronal to the alveolar crest. This can be achieved by sacrificing soft tissues/sculpting bone so that enough space exists between the tooth and the bone. Patient consent was taken. The treatment plan comprised of meticulous phase 1 therapy, followed by crown lengthening using Er: YAG laser followed by osteoplasty/ostectomy. Internal bevel incision was given using Er: YAG laser (Fig. 4). Lasing was done using contact mode; laser energy was set at 100-200 mj; pulse frequency 10-20 Hz; tip diameter used was 0.4x 17mm and water spray level set at 3-4. Crevicular incisions were given using a 15 no scalpel blade and a full thickness mucoperiosteal flap was raised till healthy bone was visible. Marginal tissue was removed using curettes. Osseous resculpting was carried out using non-contact mode. Following settings were used, laser energy 200-300mj; pulse frequency 20-25 Hz; tip diameter used was 1.0mm x17mm and water level set at 6-8 (Fig. 5). Abundant irrigation was carried out to remove debris from surgical site. Adequate clinical crown was achieved (Fig. 6). Primary closure was achieved using. 3-0 silk resorbable suture (Fig. 7). Post op instructions and medication was given to patient. PFM crown was fabricated and placed after three month (Fig. 8).

Fig. 1

Fig. 2

Fig. 3

Fig. 4

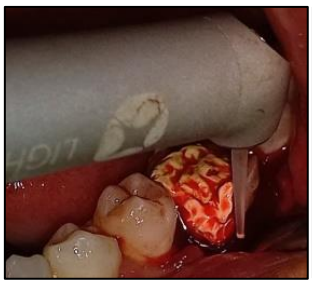

Fig. 5

Fig. 6

Fig. 7

Fig. 8

CASE 2

A 48 year old male patient reported with chief complaint of difficulty in chewing from lower right back region of the jaw. The crown structure of 46 was found to be inadequate for prosthetic crown preparation (Fig. 9). Soft tissue examination showed healthy gingiva with no pockets. Adequate width of attached gingiva was present. There was no loss of clinical attachment. Systemically the patient was healthy. Endodontic treatment of the above teeth had already been completed by the patient earlier. The treatment plan included full mouth thorough scaling, followed by crown lengthening and osteoplasty/ostectomy. Routine haemogram analysis was carried out. Patient consent was taken for treatment.

As the sulcus depth was 2mm, it was decided to go for internal bevel incisions of the concerned tooth both buccally as well as lingually. Surgical technique was performed with Er: YAG laser (Lite Touch, Light Instruments, Yokneam Illit, Israel). Lasing was done using same parameters as in case 1 (Fig. 10). Crevicular incisions followed next with a 15 no scalpel blade and a full thickness mucoperiosteal flap was raised till two to three mm of healthy bone was visible. Severed gingival tissue was removed to gain access to underlying alveolar bone and the roots. Using curettes granulation tissues and tissue tags were removed (Fig. 11). The amount of osteoplasty and/or osteotectomy required was to be estimated keeping in mind the dimensions of biologic width of future reconstructions. Bone remodelling was carried out using non-contact mode as in case 1. Lasing was done using following settings, laser energy 200-300mj; pulse frequency 20-25 Hz; tip diameter used was 1.0mm x17mm and water level set at 6-8.

The bony contour was scalloped parallel to cemento enamel junction. Thorough root planing was carried out to prevent any reattachment of connective tissue fibres with under surface of flap. The final shaping of osteoplasty and osteotectomy was performed with hand curettes in order to avoid damaging the root. Desired crown lengthening was achieved (Fig. 12).

Abundant irrigation was carried out to remove debris from surgical site. Flap margins were sutured using 3-0 silk suture to achieve primary closure (Fig. 13). Post-surgery necessary directives were told to the patient. Non-steroidal anti-inflammatory drug was too prescribed. Chlorhexidine mouth wash 0.2% was also prescribed for two weeks. Review was done after seven days for suture removal.

Healing was uneventful. Post and core build up was done, followed by composite restoration (Fig. 14). Porcelain fused metal crown was fabricated and cemented after three month (Fig. 15). Follow up of one year showed no undesirable observations around the prosthesis.

Fig. 9

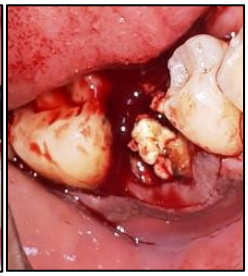

Fig. 10

Fig. 11

Fig. 12

Fig. 13

Fig. 14

Fig. 15

CASE 3

A 33 year old male patient was referred for crown lengthening with respect to 37. Short clinical crown was evident in 37 (Fig. 16). Gingival sulcus was 1mm. Width of attached gingiva was adequate. Patient was healthy with no medical history. Root canal treatment of the teeth in question was completed by the referring dentist. Routine blood investigation was carried out. Patient consent was taken. The treatment plan comprised of meticulous phase 1 therapy, followed by crown lengthening using Er: YAG laser followed by osteoplasty/ostectomy. Since soft tissue was inadequate, internal bevel incision was given using Er: YAG laser (Fig. 17). Lasing was done using contact mode; laser energy was set at as in above cases. Crevicular incisions were given using a 15 no scalpel blade and a full thickness mucoperiosteal flap was raised till healthy bone was visible. Marginal tissue was removed using curettes. Bone resculpting was carried out using non-contact mode as employed earlier. Abundant irrigation was carried out to remove debris from surgical site. Primary closure was achieved using. 3-0 silk resorbable suture (Fig. 18). Post op instructions and medication was given to patient. Healing was satisfactory and adequate crown length achieved (Fig. 19). PFM crown was fabricated and placed after three month (Fig. 20). Follow up after six months showed stable results.

Fig. 16

Fig. 17

Fig. 18

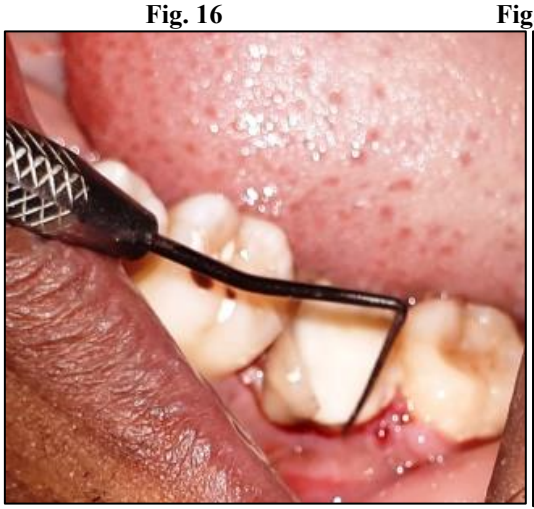

Fig. 19

Fig. 20

DISCUSSION

Well defined prepared margin is basic necessity for fabricating prosthesis. If the margins of crowns are placed in gingival sulcus, undesirable situation arises for impression making. Clinical situations where crown margins extend deeply below gingival sulcus, controlling crown margins might be compromised. Consequently increasing length of crown might be the best option.

Biologic width comprises of connective tissue (1.07mm) and junctional epithelium (0.97mm) [1].

The dento gingival complex remains static. The gap from crestal bone till the margins of gingiva is 3mm. This gap constitutes of gingival sulcus (0.69mm), epithelial attachment (0.97mm) and fibres from connective tissue (1.07mm) [4].

Crown margins placed within the confines of gingival sulcus violates biologic width and often leads to gingival inflammation, periodontal pocket formation, alveolar bone loss and clinical attachment loss.

Exposure of subgingival caries, preservation and maintenance of restorations, aesthetic enhancement, restorative procedure without damaging biological width, and maintaining oral hygiene are the objectives achieved by crown lengthening [5].

The gap between alveolar crest and gingival margin and relative position of future restorative margin are of prime importance for the clinician [6]. Distance between CEJ and alveolar crest, adequate attached gingiva and the presence of pocket are the important landmarks to prevent any ingress into biologic width [5].

Various methods can be employed to achieve considerable amount of crown length. Gingivectomy is advocated if probing pocket depth is more than four mm along with ample attached gingiva. Apically positioning of flap is carried out in situation where probing pocket depth is four mm but accompanied by deficient attached gingiva. Internal bevel gingivectomy with osseous reshaping is carried out in patients with short clinical crowns [7]. So in our all the patients, internal bevel gingivectomy followed by osteoplasty was carried out.

Lasers like CO_2 and Nd: YAG have been extensively used in periodontics for soft tissue manipulations namely curettage, gingivectomy, frenectomy and crown lengthening. However, periodontium comprises of hard tissue component along with soft tissue. The above quoted lasers results in carbonization and thermal damage to periodontium. Er: YAG (2.94µm wavelength) and Er: YSGG (2.79µm wavelength) are the only lasers giving predictable outcomes with hard tissue interaction [8].

Er: YAG laser had shown to be successful in ablating hard tissues, caries and dental calculus [9, 10]. This laser was proved to be an efficient in osseous surgery, with least thermal damage to bone [11].

Er: YAG lasers have been utilized for different osseous procedures including crown lengthening. Bactericidal effectiveness, less agony and vibrations to the patient, no tissue damage and healing complications, effectiveness in osseous manipulation are advantages over other laser system [12]. In our case series Er: YAG laser was equally effective in removing soft as well as hard tissue with no adverse outcomes.

In contrast to traditional approach of using scalpel blade and carbide burs for crown lengthening, Er: YAG laser was used as it provided with superior outcomes. Clear visibility, precise surgical cut, reduced risk of blood borne infection as laser cut enhances sterilization, less postoperative infection, no scarring of tissue. Thus, laser treatment was the chosen approach in our cases [8].

Fixed prosthesis in our patient was fabricated and delivered after three months. Tooth preparation should be delayed for at least three months after surgery. Six months is ideal for fabricating crowns when thin periodontal biotype is encountered [13]. Hence, in our patient the fixed prosthesis was placed after three months as periodontal biotype was not thin. The biological width regains its dimension after six months following surgery [14].

CONCLUSION

Many patients undergo extraction of teeth with inadequate crown length. Dentists too are not keen on preserving such teeth. The main thrust should be preservation rather than sacrificing tooth. Profound knowledge of biologic width and preventing its violation certainly delivers stupendous results in terms of restorative procedures. Challenging cases to restore inadequate clinical crowns can be overcome by respecting biologic width. With laser making strides in dentistry, laser should be employed for painless and all round benefit. Er: YAG laser is a masterstroke in clinical field as it can manipulate soft and hard tissues.

Clinical Significance: Er: YAG laser are designed to handle both hard and soft tissues unlike their contemporaries. Aesthetic crown lengthening in anterior dentition has been reported in various case reports; this case report series enhances the functional rehabilitation of teeth with inadequate crowns with Er: YAG laser, without any untoward results in patients.

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