

CAUSE OF TECHNICAL FAILURES OF CONICAL CROWN-RETAINED DENTURE (CCRD): A CLINICAL REPORT

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Conical crown-retained denture (CCRD) has been used as a very effective treatment method in cases with few remaining teeth with heterogeneous prognosis. However, in spite of many advantages of CCRD, high technical failure rate was a problem to be considered.

Incorrect path of insertion and excessive retention were thought to be the main cause of technical failure and to result from laboratory procedure with a coping misfit and/or a coping transfer error. In order to prevent this error, secure anchoring of inner coping and re-examination and milling of convergence angle were recommended on the master model from pick-up impression.

Key Words

Conical crown-retained denture (CCRD), Technical failure, Misfit, Path, Error, Retention

Conical crown-retained denture (CCRD) is a kind of treatment modalities using double crown retainer system. It consists of an inner coping, cemented to the abutment for guaranteeing individual tooth prognosis, and an outer crown, connected to a denture and engages the inner coping.

With this hybrid form of fixed and removable prostheses, CCRD can be effectively adopted to few remaining abutments with doubtful heterogeneous prognosis.^{1,2} With secondary splinting effect of double crown, CCRD transfers occlusal forces along the long axis of abutment teeth.³ In case of abutment loss due to fracture or extraction

derived from the poor prognosis, CCRD enables easy modification with a retainer changed to a pontic.^{2,5} Retrievability is considered to be a main advantage of CCRD. In addition, CCRD has many other advantages such as patient's high satisfaction rate,^{2,6} improved chewing ability^{1,2,6} and easy periodontal hygienic care by patient.⁷ In fact, Wagner and Kern⁶ reported that CCRDs had a higher success rate than clasp-retained dentures.

With regard to the technical failure, however, CCRDs have shown higher failure rate than clasp-retained dentures.^{6,8} Hofman et al.⁸ stated that 20% of all clasp-retained dentures showed technical complications during the observation peri-

od, whereas 50% of CCRDs required repair. Wagner and Kern⁶ and Behr et al.⁹ also reported 63.9% and 48.8% technical failure rate respectively with CCRDs.

Technical problems during the observation period were loss of cementation, loss of facing, fracture of metal framework, fracture of soldering and fracture of artificial teeth.^{2,5,6,8-10} Of which, very highly occurring technical failures such as post core loss, displacement of inner coping and loss of facings seen only in CCRDs can not be explained but a retention problem related to connecting rigidity between the inner coping and the outer crown.

A few reports about clinical prognosis of CCRDs including many technical failures were published, but the cause of its failure was not reported yet. This article describes assumed cause of high technical failures of CCRD with the examples of two clinical failure cases of CCRD.

CLINICAL REPORT

Patient 1

A 43-year-old male patient had multiple restorations in his mandible: 4-unit fixed restoration with facing broken, retained on his left first premolar and left second molar, 5-unit fixed restora-

tion with poor periodontal support, retained on his left canine and right central and lateral incisors, right canine with cast post core, and amalgam core on right first molar with poor periodontal support. Right second molar was intact without any restoration (Fig. 1). According to the patient's request caused by his financial problem, it was decided to maintain anterior fixed restoration. After careful diagnosis with consideration of conversion possibility of anterior fixed restoration to the denture in the future, it was agreed to restore with a combined clasp- and conical crown-retained denture.⁶ The coronal portion of the right first molar was cut away and restored with root coping for a denture support. Through careful surveying the path of right and left second molar, they were altered parallel to the long axis of right canine and left first premolar. With a conventional procedure, inner copings and outer crowns were fabricated on right canine and left first premolar (Fig. 2). After framework soldering to outer crown, a denture was constructed as usual with a conventional procedure. When inner copings were luted to the abutments, however, it was found that excessive force was required for insertion and removal of the denture. The patient complained of the

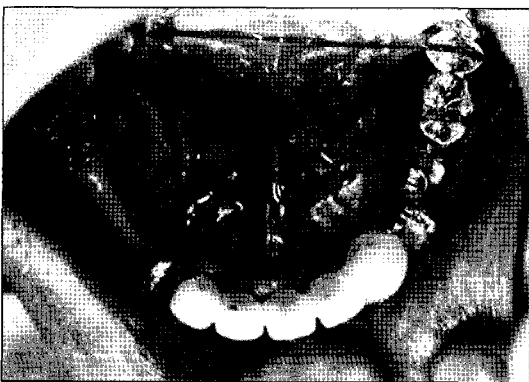


Fig. 1. Reconstruction of old prosthesis was required (Case 1).

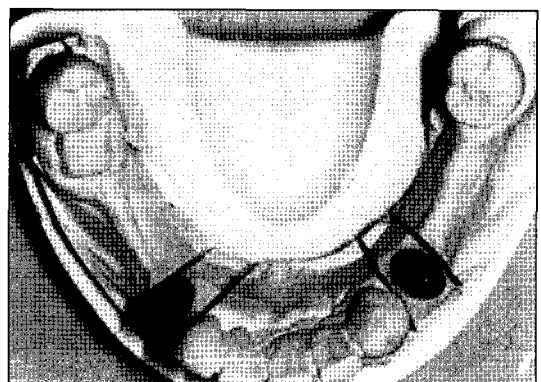


Fig. 2. Inner copings and outer resin pattern on right canine and left first premolar.

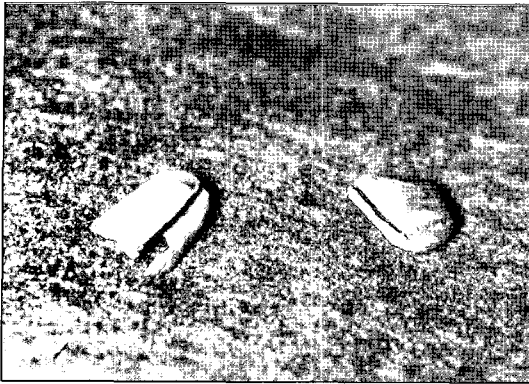


Fig. 3. Removed inner copings.

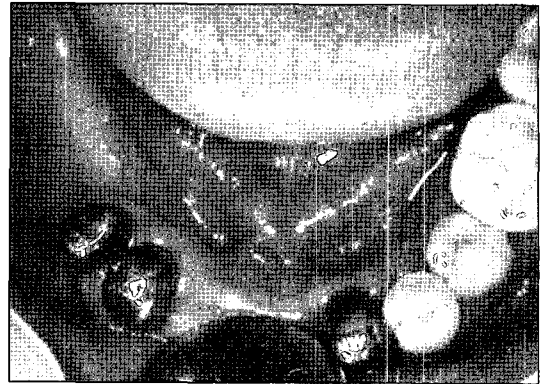


Fig. 4. Inner copings on the abutment teeth (Case 2).

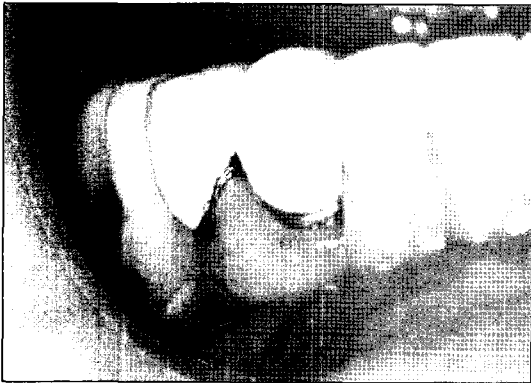


Fig. 5. Gaps were found on the second premolar after cementation.

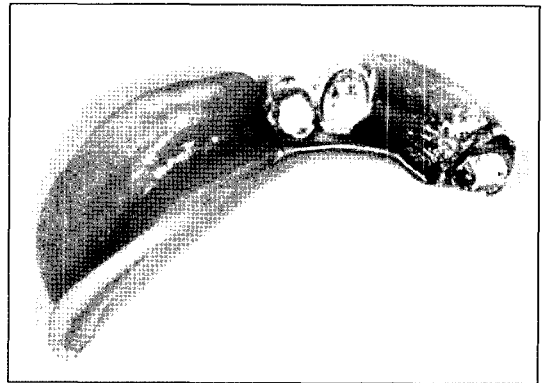


Fig. 6. Relined denture base and ill-fitting inner surface of outer crowns.

pain and difficulties of insertion and removal of a denture, so inner copings had to be removed from the abutment teeth (Fig. 3). Through remaking procedure, a new combined clasp- and conical crown-retained denture was delivered to the patient.

Patient 2

A 66-year-old male patient with loss of 4 anterior teeth, right second premolar and right molars, hoped to restore his lower arch. Because left and right canine and right first premolar had different periodontal support each other, CCRD was taken into consideration (Fig. 4). When a construct-

ed denture was inserted to the inner copings through conventional procedure, internal gaps were found both between the outer and inner crown of right first premolar, and between the residual ridge and free-end denture base (Fig. 5). Even after relining procedure, fit and retentive force of retainers were still insufficient (Fig. 6).

DISCUSSION

There were a few reports about clinical prognosis of CCRDs. Although conventional clasp-retained denture showed higher failure rate than CCRD,⁶ in many cases clasp-retained denture has been pre-

ferred to CCRD because of its relatively simple and inexpensive treatment procedure. CCRD is a very time-consuming and expensive method.

Interestingly, unaesthetic metal collar display,⁷ cervical overcontour⁴ and high cost⁷ regarded as common disadvantages of CCRD were not the problems, and most of patients were satisfied with their CCRD.^{2,6} Main problems of CCRDs were many technical complications, since CCRDs are very technique-sensitive and sophisticated to both dentists and technicians. If a dentist and a technician don't have correct concept of rigid support, failures from technical errors will increase remarkably.

Retentive force in CCRD makes secondary splinting effect of few remaining abutment unfavorably distributed in the arch. In the studies of clinical prognosis of CCRD, when excessive retention existed, loss of cementation and abutment fracture increased.^{1,8-10} In cases retentive force was poor, splinting effect of abutment by CCRD was insufficient.⁵ Thus, generation of adequate retentive force is a necessary condition for the concept of rigid support of CCRD.

In view of retention type, it is different from the telescopic crown system that shows friction all along the seating or removal procedure of superstructure. Conical crown exhibit friction only when completely seated. This is the reason it was known to show no retentive force decrease by wear of crown wall even after long function. The retention force of CCRD can be achieved by interface tension based on a wedging action of contacting taper walls.^{3,5} Thanks to this tapered configuration of inner coping, it is known to have relatively simple laboratory procedure and constant retentive force, although CCRD also has technical difficulties to get a precise fit between the inner and the outer crown.

Indeed, however, retentive force of CCRD in the mouth was known to be higher or lower than that

of the force of 5 to 10 N generated by the recommended taper.⁹ Molin et al.¹ stated that in 50% of the cases there was a marked or extremely marked retention. On the contrary, Bergman et al.² reported the decrease of retentive force of 28% and Wagner and Kern⁶ also showed that about one-quarter of the CCRDs had lost retention.

From those reports, it was thought that the principle of retentive force of CCRD could not be applicable to the clinic. That means it is difficult to get clear fit for adequate retention between the double crowns in the mouth. If retention is inadequate in the mouth even after careful milling to get exact configuration of taper wall of conical crown on the model, it can be guessed that differences of relation of each coping between on the model and in the mouth occurred.

The causes of this phenomenon could be assumed as follows. Firstly, a deficiency of passive fit of inner coping to the abutment. After incomplete seating in the mouth, relative angles of inner copings will be changed. Secondly, an unstable positioning of inner coping on the master model. To compensate for the aforementioned seating error of inner coping, in most cases pick-up impression is taken for master model. However, if duralay anchors retrofitted to inner coping are loose with excessive block-out of inner surface of copings on the model, relative angles of inner coping will be also changed. Thirdly, even though they are stable, if no milling is performed on the master model again, the differences of conical angle of each coping still exist between on the model and in the mouth. Furthermore, next step of CCRD treatment is to connect the framework of denture to the outer crown with duralay resin. Incorrect relations between the copings are transferred to the framework, thus denture base fit can be affected seriously. As seen in case of patient 2, immediate den-

ture relining is needed to get the stability.

The problem is the fact that it is very difficult prior to cementation of inner coping to ascertain that adequate and correct retention is obtained.⁴ To find inadequate or incorrect relation of conical crowns prior to cementation, secure seating of inner copings to the abutment teeth must be performed firstly and completely passive seating of a denture to the copings must be investigated. However, even with this procedure, errors might not be detected when denture seats through twisting action with minute displacement of coping and/or inner coping is removed as included in the denture from the least retentive interface of abutment in spite of incorrect relation of copings. As a result, operator experiences incomplete seating or excessive retention of denture only after cementation of inner coping. Considering that there was no correlation between the number of abutments with coping and the retention,^{8,9} inadequate retention is thought to result from the seating and transfer coping error as suggested in this report.

This phenomenon affects the prognosis of CCRD. Most technical failures such as loss of cementation,^{8,9} loss of veneer^{5,6} and fracture of framework^{8,10} are thought to be related to incorrect path of insertion. Ill-fitting denture transfers forces to the most resistible part of CCRD during the occlusion and removal procedure. Finally, it appears in the form of loss of cementation, loss of veneer and fracture of framework at an early stage or even after years. Relationship between poor prognosis of abutment and an excessive or insufficient retention forces were also found.^{5,10}

In this report, cause of technical failure was assumed but it was not based on the long-term result but on the little experiences and reported articles. Long-term follow up in relation to retentive force is necessary.

SUMMARY

After luting of inner coping, to find insufficient or excessive retention in conical crown-retained denture is not insignificant. Gap between inner coping and outer crown or removal difficulty, what was worse, incomplete seating of denture found in CCRD were assumed from the laboratory processing error occurred during coping transfer procedure from the mouth to the model. To prevent this problem, secure anchoring of inner coping and re-examination and milling of convergence angle was recommended on the master model from pick-up impression.

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