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Endodontic Failures

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The aim of endodontic treatment is success. In endodontic treatment what degree of success should be expected? Failures in endodontically treated teeth occur in less than 10 per cent of cases, as judged by the reports of some investigators. A 90 per cent success rate is regarded as excellent progress.

Strindberg (1956), Matsumiya and Kitamura (1960), Grahnen and Hannson (1961), Nicholls (1961), Grossman and Pearson (1964), Ingle (1965), Sommer, Ostrander and Crowley (1966), Seltzer et al (1963, 1964, 1965, 1967, 1968) have studied endodontic failures and their possible causes (6, 7, 11, 14, 15, 20, 21, 22, 23, 24, 25, 26). In my opinion, the best study, based on combined clinical, roentgenographic and histologic observations was undertaken by Seltzer et al (22) to uncover endodontic treatment failures.

Table : I — Summary of studies following root canal therapy on human teeth.

Author	Total Number	Number	Failures
			Per cent
Buchbinder, 1936	162	34	21
Auerbach, 1938	328	56	17
Castagnola, 1952	1000	220	22
Strindberg, 1956	529	74	14
Grahnen and Hannson, 1961	763	146	19
Nicholls, 1961	427	47	11
Seltzer et al. 1963	2921	584	20
Grossman et al, 1970	432	41	9,6
Harty et al, 1970	1139	114	10
Heling and Tamshe, 1970	213	64	30
Bayırlı, 1970	135	27	20
Total number of treated cases	8049	1407	17

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Table I sets out the overall failure rate of some studies on root canal therapy and shows that of the 8049 treatments 17 per cent failed. Failures are between 10-30 per cent.

A study based on combined clinical and roentgenographic observations was undertaken by Strindberg (26). Two types of factor were studied: Biologic factors, including health status, anatomic and pathological conditions of pulp and periradicular regions; and therapeutic factors, including forms of therapy, antibacterial treatment, canal preparation, clinical and technical complications, the root filling material and the type of root filling.

Nicholls (15) has studied that the factors which may influence the prognosis of root canal therapy. He has divided these factors into two classes: A — Factors concerning the patient, B — Factors related with the treatment.

Sommer, Ostrander and Crowley (25) have arranged endodontic failures in five classes:

- Class I : Failures due to improper selection of cases.
- Class II : Failures due to instrumentation.
- Class III : Failures due to inadequate sealing of the canal.
- Class IV : Failures due to root resection.
- Class V : Failures due to traumatic injuries.

Ingle (11) stated that the thirteen causes of endodontic failure may be divided into three general categories of causes leading to failure:

- 1 — Apical Percolation.
- 2 — Operative Errors.
- 3 — Errors in case selection.

A study based on combined clinical and roentgenographic observations was undertaken at the University of Washington School of Dentistry (Ingle et al. 1955) (11). They have found that nearly 91 per cent of all treated endodontic cases were successful, two years after treatment. But resection had been performed in some cases.

According to many authors, the possible causes of failure are:

1 — **Sex** : It has been observed that endodontic failure occurred equally in both sexes (22). Nicholls (15) stated that it is difficult to produce any reason why the sex of the patient should influence prognosis.

2 — Age : Periapical repair may be slower in aged patients, because of a low general resistance. Once, it was considered that the prognosis for root canal therapy became worse with increasing age.

Strindberg (26) found no appreciable difference between younger (35) and older (36) subjects. In the Washington study it has been found that no statistically significant difference exists between any of the age groups (11).

Seltzer et al. (19) compared the success rate of patients up to age 20 with results for patients above that age. The 11 to 20 year group presented a 87,8 per cent success rate, the group over 20 was only successful with the ratio of 81,3 %; which is a statistically significant difference. The group over 60 had a better success rate (86,0 per cent) than the younger age group.

Grossman (7) found a direct relationship between age and the body's ability to repair occurred in the group up to 19 years of age (54,8 percent), the least in the over 50 group (13,3 per cent). He pointed out that the incidence is intermediate in the 20-49-year-group.

Bayırlı (3) compared the success rate between the 11-20 year and the 21-40 year group. The success rates were 76,80 per cent and 81 per cent respectively.

Harty et al (9) showed that there is no difference between 15-29 year and the 30-44 year group. The success rates were 89,8 per cent and 89,3 per cent respectively. The success rate in the patients over 45 years of age was 93,2 per cent of cases. They concluded that the group over 45 had a better success probability (93,2 per cent) than the group below 45 (89 per cent). Therefore it is considered that age is no contra-indication to root canal therapy.

3 — Health Status :

Strindberg (26) found no appreciable difference between «healthy» and «ailing» patients.

But patients in a poor general health are generally considered to be poor endodontic risks. Their general resistance to infection is below normal, as well as their ability to repair damaged supporting bone. General systemic conditions may contribute to poor healing of the periapical tissues, such as failure to lay down collagen by the fibroblasts because of vitamin C deficiency or hormone imbalance (8).

4 — Teeth :

It has been found that the treatment results are better for three rooted teeth than for two rooted teeth and poorest for single-rooted teeth (26,6).

In the Washington study, success in the mandible was not significantly greater than in the maxilla. The highest failure rate is for upper lateral incisor (11).

Seltzer (22) found that failures occurred more than twice as frequently in maxillary teeth than in mandibular teeth. It has been reported that endodontic therapy is performed more for maxillary than mandibular teeth (19); therefore more endodontic failures would be expected in the upper teeth.

Heling and Tamshe (10) found that single-Canaled teeth are 71 per cent, while multiple-canaled teeth are 68,3 per cent successful.

5 — Periradicular Status :

There is a relationship between endodontic failures and periapical rarefaction areas prior to endodontic treatment. From the evidence of the reports, prognosis seems to be significantly better when there is no radiological evidence of a periapical area (26,6).

Seltzer et al. (19) pointed out that the prognosis for successful endodontic therapy is less favorable in teeth with regions or rarefaction, regardless of the bacteriologic status of the root canal, than for teeth without rarefaction. There was 92 per cent success in teeth without rarefaction and 76 percent in teeth with rarefaction.

Seltzer et al. (20) found 88,8 per cent success without rarefaction area, 77 per cent success with such area. These authors, in another study (22) found a ratio of 2,5 to 1.

Grossman (7) found 85,7 per cent success in the teeth with definite areas of rarefaction.

Heling and Tamshe (10) found that pulpless teeth without areas of rarefaction on the initial roentgenograms are more successful than those initial rarefactions. Per cent successful was 79,4 in the teeth without rarefaction area, the success rate was 79,4 % whereas 52,6 with such an area.

Bayırlı (3) found that the teeth without areas of rarefaction on the initial roentgenograms (84,44 per cent) are more successful than those with initial rarefactions (71 percent).

6 — Pulp Status :

Curson (5) stated that there is more chance of success following vital extirpation than with treatment when the pulp is already necrotic. Similar results have been found by Grahnen and Hannson (6); and Seltzer (23). But Strindbery (26) found that the result was just contrary.

Heling and Tamshe (10) concluded that teeth with vital pulps are more successful (77,8 per cent) than those with nonvital pulps (56, 45 per cent). The teeth with nonvital pulps were with or without areas of rarefaction.

Grossman (7) compared the success rate of vital teeth with pulpless teeth. He showed that 90,4 per cent of the vital pulp extirpation cases are more successful than 89,3 per cent of the pulpless teeth either with or without of rarefaction.

7 — Periodontal Involvement :

Seltzer et al (22) found that in anterior teeth, 34 per cent failures of periodontal lesions. Failures in posterior teeth increased to 70 per cent in case of periodontal disease.

The development of periodontal pockets and bone loss causes the exposure of lateral canals located at or near the furcation regions of molars. Such phenomena have been demonstrated by Seltzer et al (19). When lateral canals are exposed, oral fluids may seep into them. Dissolution of cementing media of the root fillings, reinfection of the root canal and periapical region then occur, and endodontic failure may result. On the other hand, lateral canals in the coronal region are rarely observed in anterior teeth; hence, the influence of periodontal disease on the failure rate of endodontically treated anterior teeth would be so significant. In the transactions of the World Conference on Endodontics, it is stated that periodontal disease should be eliminated or controlled before treating the root canal (15).

8 — Crowns of Abutments :

It has been found that endodontic failures occurred with greater frequency in teeth that were crowned or acted as bridge abutments than in those which were not so involved. Posterior teeth which were periodontally involved and crowned or served as abutments failed more frequently than similarly involved anterior teeth, (by a ratio

of 3 to 1). In such cases, traumatic occlusion might have contributed to the failure frequency (22).

9 — Bacteriological Sampling :

From the early days of endodontic therapy, investigators in endodontics have emphasized the necessity for eliminating infection from the root canal as the price for successful results (12, 17). Investigators have stressed that the culture technique is an important method of determining whether or no the infection has been eliminated from the root canal. Thus, elimination of infection, as determined by a negative culture, has become one the basic «principles» of endodontic therapy and is so stressed by many authorities (4,7).

The Second International Conference on Endodontics agreed that in all cases of root canal treatment, a negative culture should be obtained before filling the root canal (1960) (17).

Table : II — Relation of Successful Repair to Positive and Negative Cultures

Author	Root Canal culture taken immediately prior to filling	Successful			Failure	
		Total	Num ber	Per cent	Num ber	Per cent
Abramson 1961	+	38	32	84,2	6	15,8
	—	97	92	96,6	5	3,4
Rhein, Krasnow and Geis (Appleton) 1932	+	152	129	84,8	23	15,2
	—	340	320	94,1	20	5,9
Bayırlı 1970	+	38	20	52,63	18	47,34
	—	97	88	90,72	9	9,28
Seltzer et al. 1963	+	500	409	81,8	91	18,2
	—	1835	1594	84,4	286	15,6
Zeldow and Ingle (1963)	+	152	129	83,3	23	15
	—	340	320	94,5	20	6
Oliet (1962)	+	67	37	55,22	20	29,79
	—	31	26	83,87	2	6,45

(+) Positive Culture

(—) Negative Culture

Appleton (2), Abramson (1), Oliet (16), Zeldow and Ingle (28), Bayirli (1970) demonstrated that a better prognosis may be obtained when a root canal is filled following negative cultures. According to these authors a proper culturing technique should be used routinely by the dentist in order to obtain the most favorable prognosis.

Matsumiya and Kitamura (14) observed that periapical repair of endodontically treated dog teeth was the same, whether microorganisms, were present or not in the root canal. In fact, they showed that the microorganisms tend to die out in time and that attempts at sterilization were fruitless.

Seltzer et al. (19) observed that in the analysis of the success or failure of 2335 endodontically treated human teeth, the presence or absence of microorganisms within the root canal prior to filling, as determined by cultures, appeared to have surprisingly little effects on the eventual outcome.

As mentioned, until recently, most investigators considered the microbiologic culture to be an important component of endodontic treatment. Within the last few years, some studies gave results that tend to disagree with this concept. Accordingly, the end result does not appear to be related to the culture. However, this does not prove that infection played no role in the end result.

10 — Clinical and Technical Complications :

Strindberg (26) found that the occurrence of acute symptoms of inflammation during the treatment did not reduce the proportion of success. In case where a fragment of the broken file remained in the canal there was a lower proportion of successes. If the file protrudes beyond the apex, removal must be carried out, if possible, by means of root resection (3, 25).

11 — Canal Preparation :

Strindberg (26); Grahnen and Hannson (6) have found that roots that could not be reamed through the apex had a lower failure frequency than roots that could be reamed through the apex.

The importance of mechanical and chemical cleansing of root canals in endodontic treatment has been stressed by Grossman (8), Ingle (11), Nicholls (15), Sommer, Ostrander, Crowley (25) are of the opinion that one of the most common causes of failure in endodontics is the overzealous use of root canal files and reamers.

Winter and Rule (27) have demonstrated that immature teeth with necrotic pulps may be retained by a variety of endodontic techniques. In the two cases, no attempt was made to cleanse the apical area mechanically and irrigation of debris from the root canal was accomplished by the use of sterile water only; bacterial decontamination of the root canal and periapical tissues being achieved by the combined action of polyantibiotic paste and the normal body defence mechanism. The excellent results occurred.

Seltzer et al. (23) have found that the tissue reaction following instrumentation short of the apex were milder than those reactions which followed instrumentation beyond the apex.

Instrumentation beyond the apical foramen is always harmful. Firstly it injures and therefore irritates the periapical tissues. Secondly, it makes the extrusion of material into the periapical tissues during root filling, by widening the apical foramen. Thirdly, it increases considerably the risk of driving debris and micro-organisms from the pulp cavity into the periapical tissues.

12 — Antiseptic Drugs :

Many antiseptic drugs formerly used root canal treatment such as beechwood creosote, azochloramid, cresatin or camphorated-parachlorophenol, are very irritant to living tissues. There is no practicable way of preventing the diffusion of drugs from the root canal into the periapical tissues. Highly irritant ones should not be used as root canal antiseptics. Also, root canal antiseptics, such as polyantibiotic pastes, should not be inserted beyond the apical end of the canal. This applies especially to preparation in the form of a paste or cream, since the pressure of these on the periapical tissues will also lead to physical irritation.

Grossman et al (7) have reported that the percentage of successful results was higher in teeth with antibiotics (93, 2 per cent). They have stated that this might be due to lack of irritation by the antibiotics used.

13 — Level of Root Filling :

Kuttler (13) found that the distance between the centre of the foramen and the root apex varies from 0,5 mm. in a young to 0,7 mm. in an older person. He suggested that the final root filling material should be 0,5 mm. short of the apex to allow the deposition of se-

condary cementum to occlude the apical opening from the level of the dentino-cemental junction.

The studies have shown that the highest percentage of success results from filling the canal just short of apex. The prognosis is poorer if the filling penetrates into the periapical tissues and filling just to the apex gives an intermediate success rate (6, 26).

In the Washington study, 58 per cent of failures (104 endodontic failures) caused by incomplete obliteration of the canal (canal overfilled 3 per cent of failures, canal unfilled 2 per cent of failures) have been found (11).

Seltzer et al. (19) showed that successful repair amounts to 70,6 per cent in overfilled canals, 87,2 per cent in underfilled canals, and 86,8 per cent in the canals which are filled flush with the apex.

Seltzer et al (20) carried out an experimental study, in the teeth of dogs. They observed that the most severe inflammatory responses appeared to occur as a result of overfilling root canals, thereby effecting foreign bodies mechanically on the periapical tissues. In addition, severe inflammatory responses occurred around particles of root canal cement forced into the periapical tissues by the root filling procedures.

Winter and Rule (27) observed that successful calcsific occlusion occurs best where the root filling is carried to within 1 to 2 mm. of the apex.

Heling and Tamshe (10) found that filling to the apex results in a greater degree of success than do overfilling or underfilling (to apex 71 per cent of success, overfilling 57,1 per cent of success, underfilling 68,4 per cent of success). Harty et al (9) showed that root fillings placed within 1 mm. of radiographic apex of the tooth were the most successful. Of the «short» and the «long» root fillings, the «short» patterns had a marginally better chance of success than the root fillings that protruded past the apex. Short 87, 82 per cent of successful, long 86, 81 per cent of successful satisfactory 92, 60 per cent of successful.

Bayırlı (3) has pointed out the completeness of filling effect on the success of repair. He found that the overall percentage of teeth with successful repair is only 65, 51 per cent, if the canal were over-filled; 93, 61 per cent, if the root filling was carried to within 1 to 2 mm. of the apex; 81, 35 in the canals which are filled flush with apex.

Ö Z E T

Endodontik Tedavide, % 90 bir başarı fevkalâde olarak kabul edilir. Birçok araştırmacılar bu başarı oranını yükseltmek için çalışmışlardır. Yapılan araştırmalar sonunda elde edilen başarısızlık oranları % 10-30 arasında değişmektedir (Tablo: 1).

Strindberg (26); Nicholls (15); Sommer, Ostrander ve Crowley (25); Ingle (11) endodontik başarısızlık sebeplerini incelemişler ve her müellif kendi görüşüne göre bunları sınıflandırmıştır. Bu makalede geniş bir literatür tetkiki yapılarak endodontik başarısızlık sebepleri incelenmiştir. Her sebep için olumlu ve olumsuz görüşler izah edilmiştir.

Endodontik başarısızlığa tesir eden faktörler şunlardır :

- | | |
|-------------------------------|---|
| 1 — Cinsiyet | 8 — Kuron veya köprüler |
| 2 — Yaş | 9 — Bakteriyolojik kontrol |
| 3 — Sıhhi Durum | 10 — Klinik ve teknik komplikasyon'lar. |
| 4 — Dişlerin durumu | 11 — Kanalin hazırlanması |
| 5 — Periapikal dokunun durumu | 12 — Antiseptik ilaçlar |
| 6 — Pulpa | 13 — Kanal dolgusunun seviyesi. |
| 7 — Periodontal hastalık | |

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