# Spaced Dentition

## An Epidemiologic Study

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**A study of the incidence of spaced dentition in 1269 subjects between 12 and 18 years of age, finding about a 50% incidence and no sexual dimorphism in the older age groups.**

KEY WORDS: • DIASTEMA • SPACED DENTITION •

One of the characteristic features of a normal occlusion is arch continuity, as expressed by proximal contact between all teeth in each dental arch. Factors such as mesial drift, transseptal fibers, the slope of occluding cusps and the direction of occlusal forces contribute to the maintenance of this continuity (LUNDSTRÖM 1969, MOYERS 1972 AND VAN BEEK 1977). The loss of contact, as through loss of proximal tooth material, is viewed as detrimental to arch integrity and normal dental function.

Nevertheless, the dental arches of a considerable number of individuals show spaces between some, or even all, of the teeth. Such dental arches are known as *spaced dentition.* The scarce relevant information in the literature is based partially on clinical observations and partially on studies pertaining to the relationship between tooth size and the basal skeletal arch (Seipel 1946, Lavelle 1969 and 1970, Foster 1970).

Hemley (1971) regarded the spaced dentition found in about one third of the population as a normal variation. He maintained that in this pattern the occlusal plane is flat, the arcial inclinations of the teeth, mesial drift and anterior component of force are absent, and mastication is accomplished by bilateral closure with vertical masticatory strokes. According to this author, arch continuity is preserved during occlusal contact when each tooth of one arch comes into contact with two teeth of the opposing arch.

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The present epidemiologic study was undertaken and designed to fill a gap in the knowledge about spaced dentition, specifically its prevalence, distribution according to sex and age, number and location of the spaces, and their widths.

## — Material and Methods —

The subjects of this clinical study are all junior and senior high school students between 12 and 18 years of age, all residing in Jerusalem. Subjects with retained deciduous teeth, or partially erupted, extensively restored, decayed or missing permanent teeth were not included in the sample. Those in whom habits, abnormal soft tissue activity, malocclusion, periodontal condition or orthodontic treatment might affect spacing were also excluded.

Of the 2400 adolescents examined, 635 males and 644 females (1279 total) fulfilled the selection criteria. The male and female samples were further subdivided into three age groups, 12-14, 14-16 and 16-18 years. Each subgroup consisted of about 200 subjects, thus supplying a statistically adequate sample size for an epidemiologic study.

All subjects were examined by the same investigator. A specially composed chart was used to record pertinent personal data and interdental spacing from the left first molar to the right first molar. Spacing between the teeth was estimated by van Beek's method (1977), using metal feeler gauges graduated in 0.1mm stages. Spacing was recorded whenever a 0.2mm gauge could be passed freely without force between two adjacent teeth. A dentition having one or more spacings was defined as a spaced dentition.

In a random sample of 60 of the participating students, the exact width of each space was determined with these gauges to obtain a representative range of tooth separation.

In the statistical analysis of data dealing with the location of spacings, confidence intervals were calculated with confidence limits of 95%. The differences between sex and age groups were evaluated by means of the $\chi^2$ test at a significance level of $p < 0.05$.

## — Findings —

Among the 1279 subjects in this investigation, 622 (48.6%) had at least one interdental space (Table 1). The statistically significant difference between the sexes in the entire sample (51.8% in males, 45.5% in females; $p < 0.05$) was found to be due only to differences existing in the 14YR-16YR age group.

The incidence of spaced dentition decreased with age. In girls this became evident at age 14 ($p < 0.05$), whereas in the boys the decrease was not statistically noticeable until age 16 ($p < 0.01$).

Spacing in both arches was found in 24.1% of all examined subjects. Incidence of spacing only in the upper arch was 16.6%; in lower arch only it was 7.9%. Spacing in the lower arch only was found mostly in females.

The overall distribution was statistically significant at a 95% level of confidence, and similar proportions were found in all age and sex subgroups (Fig. 1).

Spacing was most frequently distributed in all four quadrants of the dentition (95% confidence limits). Bilateral or unilateral spacing in the upper arch occupied the second place in sequence of frequency, with bilateral occurrence more common in boys and unilateral more common in girls (Table 2).

Of the 22 possible spacing locations, 41.6% of the subjects with spaced dentition demonstrated only 1 to 3 spaces (Fig. 2). The diminishing numbers with multiple spacing stood in direct relation to

Table 1

Prevalence of Spaced Dentition
Related to Age and Sex

| HEAD | Females | | | Males | | | Total | | |
|---|---|---|---|---|---|---|---|---|---|
| Age | N | Spaced | | N | Spaced | | N | Spaced | |
| 12-14 | 205 | 109 | 53.2% | 202 | 107 | 53.0% | 407 | 216 | 53.1% |
| 14-16 | 206 | 85 | 41.3% | 233 | 136 | 58.0% | 439 | 221 | 50.3% |
| 16-18 | 233 | 99 | 42.5% | 200 | 86 | 43.0% | 433 | 185 | 42.7% |
| Total | 644 | 293 | 45.5% | 635 | 329 | 51.8% | 1279 | 622 | 48.6% |

Table 2

Distribution of Dental Spacing
by Arch Quadrant

| | Female | | Male | | Total | |
|---|---|---|---|---|---|---|
| Quadrant | N | % | N | % | N | % |
| Maxillary Unilateral | 48 | 16.8 | 35 | 10.7 | 83 | 13.6 |
| Mandibular Unilateral | 23 | 8.0 | 25 | 7.7 | 48 | 7.8 |
| Maxillary Bilateral | 43 | 15.0 | 72 | 22.1 | 115 | 18.8 |
| Mandibular Bilateral | 41 | 14.3 | 27 | 8.3 | 68 | 11.1 |
| Opposing Quadrants | 7 | 2.4 | 6 | 1.8 | 13 | 2.1 |
| Diagonal Quadrants | 5 | 1.7 | 2 | 0.6 | 7 | 1.1 |
| Both upper One Lower | 17 | 5.9 | 28 | 8.6 | 45 | 7.5 |
| Both Lower One upper | 21 | 7.3 | 16 | 4.9 | 37 | .0 |
| All Four Quadrants | 81 | 28.3 | 115 | 35.3 | 196 | 32.0 |

These data do not include the 1.6% with midline diastema only

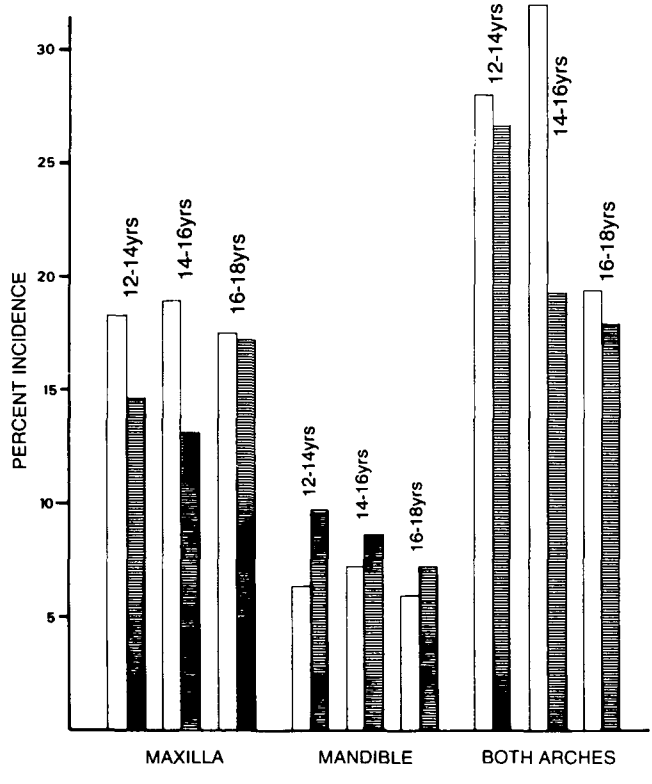


**Fig. 1** **Prevalence of spaced dentition related to location of spaces Males–open bars; Females–shaded bars.**

the increasing number of spaces per person. Only two were found with 17 spaces and one 21 spaces, all in the 12YR-14YR male age group.

The mean number of spaces for subjects exhibiting spacing was $5.5 \pm 4.1$, with a median of 4.5. The difference between sexes was significant ($p < 0.05$), with mean values of $6.0 \pm 4.3$ for males and $5.0 \pm 3.7$ for females. The mean number of spacings decreased with increasing age (Table 3).

Single spacings seldom occurred as a midline diastema. Although a midline diastema was present in 36.8% of the subjects, it was the *only* spacing in only 1.6% of those with spaced dentition (Table 4).

In the 622 children with spaced dentition, a total of 3428 spaces was recorded (Table 5). The majority of these spaces were on either side of upper or lower cuspids, while spaces between the upper central and lateral incisors occupied the second place in frequency of occurrence. The number of spaces between second bicuspids and first molars was negligible.

Width of spaces ranged between 0.2mm and 3.0mm (Table 6), with the largest mean values appearing for the upper cuspid-bicuspid (1.0mm) and lower cuspid-bicuspid (1.1mm) spaces.

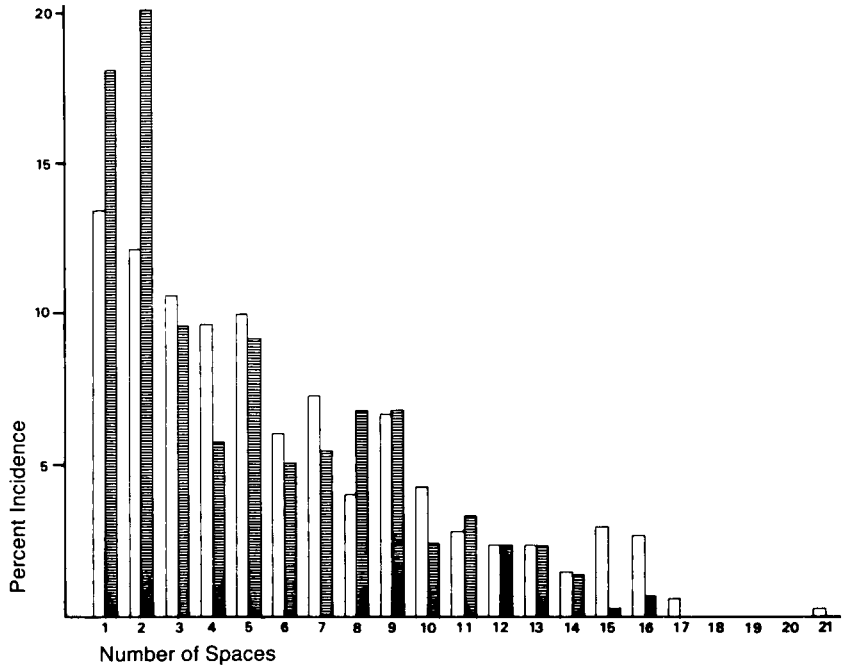


**Fig. 2** Distribution of subjects with spaced dentition according to number of spaces per individual
Males–open bars; Females–shades bars

## — Discussion —

Most dentists, and perhaps orthodontists in particular, regard spaces between the teeth and the concomitant changes in intercuspation, overbite and overjet as a form of malocclusion. The exceedingly high percentage of 48.6% of subjects with otherwise normal but nevertheless spaced dentition found in this population supports Hemley's (1971) claim that spacing is an acceptable variation in the normal occlusal pattern, not a malocclusion.

It is probable that the incidence of spaced dentition differs in various populations. However, comparison with similar investigations was not possible. Other studies have been either based on non-representative samples (Lavelle 1970), or only a limited range of space widths have been recorded (Helm 1970 and Lavelle 1976). As spaced dentition is characterized by lack of proximal contact between the teeth, the width of these proximal intervals is of little account from the physiological point of view, and was therefore not enlarged upon in the current study.

The reduction in the antero-posterior dimension of young permanent dental arches described by Lundström (1969) was expressed in our sample by a lower percentage of subjects with spaced dentition in the older age ranges (Table 1), as well as by the lower number of spaces per person (Table 3).

The fact that this decrease became apparent in girls at the age of 14, but not until 16 in boys, may be ascribed to the

Table 3

Spaces per Subject
Mean and Median Numbers by Age and Sex

| | Females | | | Males | | |
|---|---|---|---|---|---|---|
| Age | N | Mean ± S.D. | Median | N | Mean ± S.D. | Median |
| 12-14 | 109 | 5.6±3.9 | 5.0 | 107 | 6.3±4.8 | 4.6 |
| 14-16 | 85 | 4.6±3.6 | 3.4 | 136 | 6.5±4.2 | 5.6 |
| 16-18 | 99 | 4.6±3.1 | 3.1 | 86 | 4.8±3.6 | 4.0 |
| Total | 293 | 5.0±3.9 | 3.9 | 329 | 6.0±4.3 | 4.9 |

Table 4

Midline Diastemas in Spaced Dentitions

Males

| | ♂12yr–14yr | | ♂14yr–16yr | | ♂16yr–18yr | | Total ♂ | |
|---|---|---|---|---|---|---|---|---|
| | N | % | N | % | N | % | N | % |
| Upper Diastema with Other Spacings | 26 | 24.3 | 41 | 30.1 | 18 | 20.9 | 85 | 25.8 |
| Lower Diastema with Other Spacings | 2 | 1.9 | 7 | 5.1 | 2 | 2.3 | 11 | 3.3 |
| Upper and Lower Diastemas with Other Spacings | 12 | 11.2 | 8 | 5.9 | 4 | 4.7 | 24 | 7.3 |
| Upper Diastema only | – | – | 1 | 0.7 | 2 | 2.3 | 3 | 0.9 |
| Lower Diastema only | – | – | – | – | – | – | – | – |
| Spaced Dentition No Diastema | 67 | 62.6 | 79 | 58.1 | 60 | 69.8 | 206 | 62.6 |

*Continued*

earlier maturation of females. It is of interest that after the age of 14, the incidence of spaced dentition and the number of spaces was essentially constant in females. The same constancy following puberty for both sexes was observed for the maxillary diastema by Lindsey (1977).

It may therefore be surmised that final stability of spacing in males is attained at a somewhat later age, and that the incidence of spaced dentition as found in the 16YR-18YR age group (42.7%) more truly reflects the incidence of this condition in young adults.

In various investigations (Lavelle 1969 and 1976, Foster 1970, Helm 1970), as well as in the present study, spaced dentition was found to be predominant in males. However, closer examination of the differences between the sexes renders this finding questionable (Table 1).

The sexual dimorphism of the total sample was but a reflection of the 14YR-16YR adolescent age group. In this period of their development, the length of most female dental arches had already undergone reduction, while the male arches were still less mature. In the highest age group studied, the frequency of spaced dentition and the number of spaces per subject were the same in both sexes.

In about half of the subjects with spaced dentition the spaces appeared in both arches, quite evenly distributed among all four dental quadrants. In those with spaces in only one dental arch, incidence in the maxillary arch was twice that in the mandibular arch.

The tendency for spaces to be located around cuspids has also been noted by other investigators (Seipel 1946, Lavelle 1969, and Sanin 1969). The reason for this remains unknown, but it might be ascribed to the position of the cuspids in the dental arches and their function in mastication.

Hemley (1971) claims that the first occlusal contact in any lateral masticatory

Table 4

Midline Diastemas in Spaced Dentitions, *Continued*

| Females | | | | | | | | Totals | |
|---|---|---|---|---|---|---|---|---|---|
| ♀ 12yr–14yr | | ♀ 14yr–16yr | | ♀ 16yr–18yr | | Total ♀ | | TOTAL ♂+♀ | |
| N | % | N | % | N | % | N | % | N | % |
| 34 | 31.2 | 20 | 23.5 | 19 | 19.2 | 73 | 24.9 | 158 | 25.4 |
| 1 | 0.9 | 2 | 2.4 | 8 | 8.1 | 11 | 3.8 | 22 | 3.5 |
| 6 | 5.5 | 5 | 5.9 | 4 | 4.0 | 15 | 5.1 | 39 | 6.3 |
| | 2.8 | 1 | 1.2 | 2 | 2.0 | 6 | 2.0 | 9 | 1.4 |
| 1 | 0.9 | – | – | – | – | 1 | 0.3 | 1 | 0.2 |
| 64 | 58.7 | 57 | 67.1 | 66 | 66.7 | 187 | 63.8 | 393 | 63.2 |

Table 5

Distribution of Spaces
According to Location between Teeth

| | 1–1 | | 1–2 | | 2–3 | | 3–4 | | 4–5 | | 5–6 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | N | % | N | % | N | % | N | % | N | % | N | % |
| **Males — 1970 spaces** | | | | | | | | | | | | |
| Maxilla | 112 | 5.7 | 283 | 14.7 | 344 | 17.5 | 392 | 19.9 | 69 | 3.5 | 8 | 0.4 |
| Mandible | 35 | 1.8 | 91 | 4.6 | 185 | 9.4 | 321 | 16.3 | 101 | 5.1 | 29 | 1.5 |
| **Females — 1458 spaces** | | | | | | | | | | | | |
| Maxilla | 92 | 6.3 | 170 | 11.7 | 206 | 14.1 | 269 | 18.4 | 61 | 4.2 | 3 | 0.2 |
| Mandible | 29 | 2.0 | 86 | 5.9 | 172 | 11.8 | 276 | 18.9 | 80 | | 14 | 1.0 |
| **Total Sample — 3428 spaces** | | | | | | | | | | | | |
| Maxilla | 204 | 6.0 | 453 | 13.2 | 550 | 16.0 | 661 | 19.3 | 130 | 3.8 | 11 | 0.3 |
| Mandible | 64 | 1.9 | 177 | 5.2 | 357 | 10.4 | 597 | 17.4 | 181 | 5.3 | 43 | 1.3 |

Table 6

Width of Interdental Spaces
(Millimeters)

| Space Location | Males | | | | Females | | | |
|---|---|---|---|---|---|---|---|---|
| | N | Low | Mean | High | N | Low | Mean | High |
| **Maxilla** | | | | | | | | |
| 1–1 | 10 | 0.3 | 0.7 | 1.5 | 12 | 0.2 | 0.9 | 3.0 |
| 1–2 | 25 | 0.2 | 0.7 | 1.3 | 19 | 0.2 | 0.4 | 1.0 |
| 2–3 | 32 | 0.2 | 0.5 | 1.0 | 23 | 0.2 | 0.5 | 1.6 |
| 3–4 | 31 | 0.3 | 1.0 | 1.9 | 31 | 0.2 | 0.7 | 1.8 |
| 4–5 | 5 | 0.3 | 0.5 | 0.9 | 9 | 0.2 | 0.3 | 0.5 |
| 5–6 | 0 | | | | 0 | | | |
| **Mandible** | | | | | | | | |
| 1–1 | 3 | 0.2 | 0.4 | 0.9 | 3 | 0.3 | 0.4 | 0.5 |
| 1–2 | 5 | 0.2 | 0.5 | 0.9 | 10 | 0.2 | 0.5 | 1.1 |
| 2–3 | 16 | 0.2 | 0.5 | 1.0 | 25 | 0.2 | 0.5 | 1.0 |
| 3–4 | 23 | 0.2 | 1.1 | 2.1 | 40 | 0.2 | 0.8 | 2.7 |
| 4–5 | 10 | 0.3 | 0.6 | 1.7 | 17 | 0.2 | 0.6 | 2.4 |
| 5–6 | 5 | 0.2 | 0.5 | 1.0 | 5 | 0.2 | 0.3 | 1.0 |

movement is between the inclined planes of the upper and lower cuspids. This causes the cuspids to move toward their neighboring teeth and, acting alternately from side to side, contributes actively to the establishment of continuous dental arches. In the bilateral vertical masticating pattern typical of spaced dentition, there is no such inducement for cuspid movement, leaving spaces on both sides of these teeth.

Midline spacing was almost always accompanied by other spacings, a finding also reported by Sanin (1969) and Popovich (1979). The tooth size/bony arch length discrepancy is evidently not expressed uniquely in the midline region in the absence of other causes.

Many aspects of spaced dentition remain unstudied. These include general relationships such as the form of the dental arches, their relationship to one another and to basal bone, and overall skeletal relations. Even the anatomy of the periodontium, the supraalveolar fibers in particular, and their physiologic response to the spaced condition, have yet to be studied in detail. Considering the abundance of this dental pattern, further inquiries seem to be indicated.

## — Summary —

This epidemiologic study deals with the incidence of spaced dentition in 1279 students between the ages of 12 and 18 years. The sample includes only those with a full complement of permanent teeth (third molars were not considered) and with no apparent etiological conditions that might lead to disruption of dental arch continuity. The sample was evenly divided by age and sex.

Frequency of spaced dentition was high, occurring in 51.8% of males and in 45.5% of females. Prevalence was less in higher age groups, and the sexual dimorphism that was significant in the 14YR-16YR group was not found in the 16YR-18YR group.

The mean number of spaces per subject was $6 \pm 4.3$ for males and $5 \pm 3.7$ for females, again displaying diminishing incidence with age and a concomitant absence of the sexual dimorphism in the highest age group.

Spaces were found in both arches in 49.5% of the spaced dentitions, and in only the maxillary arch in 34.3%. Incidence of spacing in the mandibular arch alone was only 16.2%. In most subjects the spaces were distributed equally between the two quadrants of each arch. The most common sites and largest space widths in either dental arch were found between cuspids and the first bicuspids and between cuspids and lateral incisors.

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The Angle Orthodontist Volume 55, Number 2

April 1985

*Established in 1930 by the co-workers of Edward H. Angle, in his memory*

Published quarterly by the
Angle Orthodontists Research and Education Foundation, Inc.





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