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THE EFFECT OF DELAYED CONDENSATION UPON THE CRUSHING STRENGTH OF AMALGAM

by

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In a previous study on the effect of delayed condensation upon the mercury content of amalgam *Jørgensen et al.* (1964) showed that the relation between the increase in mercury content and the time of delay was rather moderate, on an average about 0.35 % per minute. Based on a similar, though less extensive investigation *Phillips* (1957) reported values of the same order. He also studied the influence of delayed condensation upon the crushing strength of amalgams, and found that even after a relatively short (6 min.) delay of the condensation a considerable loss of strength occurred. The present work was undertaken to examine to what extent the crushing strength of amalgams is affected by the time elapsing before the finished mix is condensed. For this purpose alloy brands which must be regarded as typical of the Danish market were used.

METHODS

The amalgam specimens were prepared essentially as described in the abovementioned study using a steel cylinder, 5 mm in diameter, with pistons fitting within the cavity. The condensation time was 3 minutes, and the pressure either 15.6 or 40 kg (0.78 or 2 kg per mm²). This method produced well-

standardized specimens with mercury contents corresponding to light and heavy hand condensation, respectively. The specimens were all 10 ± 0.5 mm long, and were condensed 2, 3, 5, or 10 minutes after completion of the mix. They were then stored one week at room temperature before crushing in a Losenhausen testing machine with a loading rate of 10 kg per second.

The tests were run with four different products, viz., True Dentalloy, New True Dentalloy, STA 68, and DAB Argos. Twenty specimens were made from each alloy for each condensation time. They were in all cases without macroscopic faults. If condensation was delayed appreciably beyond the 10-minute period such faults could not be avoided.

RESULTS AND DISCUSSION

Table 1.

Relation between delayed condensation and crushing strength of amalgams.

Condensing pressure 2.00 kg/mm².

Crushing strength and standard deviation are given in kg per cm².

| Alloy | Time of delay, min. | | | | |
|--------------------|---------------------|----------------|----------------|----------------|----------------|
| | $\frac{1}{2}$ | 2 | 3 | 5 | 10 |
| True Dentalloy | 4014 \pm 95 | | 3971 \pm 142 | 3925 \pm 136 | 3469 \pm 89 |
| New True Dentalloy | 4178 \pm 112 | 4118 \pm 119 | | 4013 \pm 92 | 3646 \pm 123 |
| STA 68 | 4125 \pm 88 | 4087 \pm 107 | | 4003 \pm 129 | 3923 \pm 67 |
| Argos | 3447 \pm 91 | 3306 \pm 82 | | 3024 \pm 156 | 2996 \pm 160 |

Table 2.

Relation between delayed condensation and crushing strength of amalgams.

Condensing pressure 0.78 kg/mm².

Crushing strength and standard deviation are given in kg per cm².

| Alloy | Time of delay, min. | | | |
|--------------------|---------------------|----------------|----------------|----------------|
| | $\frac{1}{2}$ | 2 | 5 | 10 |
| True Dentalloy | 3647 \pm 113 | 3619 \pm 128 | 3524 \pm 94 | 3255 \pm 140 |
| New True Dentalloy | 3863 \pm 122 | 3680 \pm 149 | 3462 \pm 144 | 3274 \pm 227 |
| STA 68 | 3846 \pm 97 | 3668 \pm 58 | 3429 \pm 168 | 3242 \pm 306 |
| Argos | 3410 \pm 48 | 3349 \pm 112 | 3231 \pm 156 | 2948 \pm 224 |

The results of the tests are shown in Tables 1 and 2 and in Figures 1 and 2. It is seen that all the amalgams decrease in crushing strength with prolonged time between finishing of the

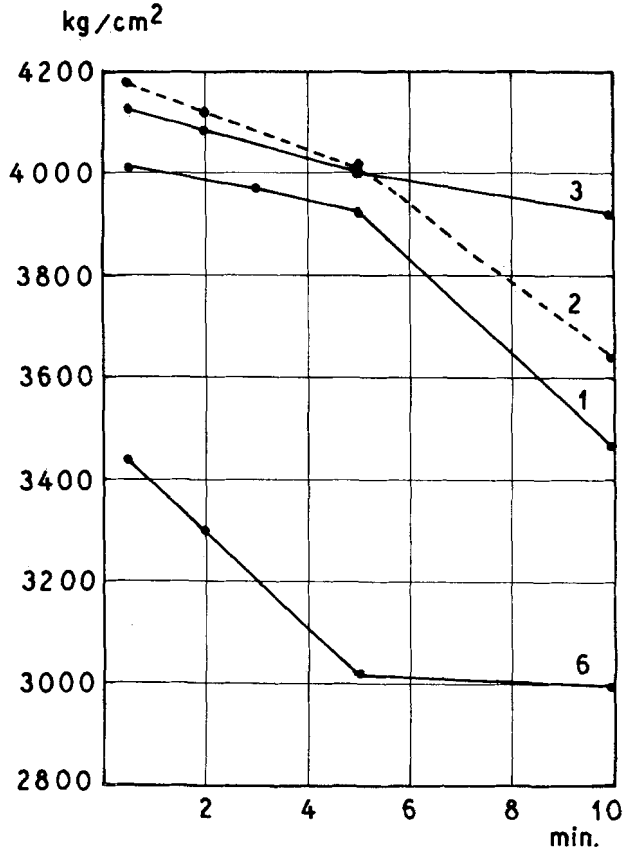


Fig. 1. Crushing strength of amalgams plotted against delayed condensation. Condensing pressure 2.00 kg/mm². 1, True Dentalloy. 2, New True Dentalloy. 3, STA 68. 6, Argos.

mix and start of condensation. The average reduction in strength per minute delay is roughly 50 kg per square centimeter, i.e. 1.3 % of the maximum strength. Consequently, a delay of a few minutes will not appreciably weaken the amalgam.

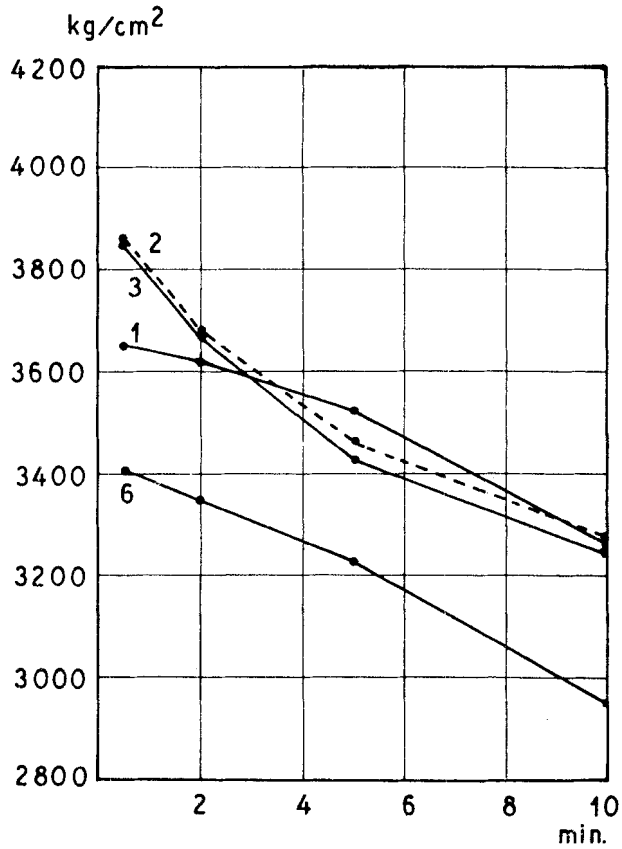


Fig. 2. As Figure 1, but with a condensation pressure of 0.78 kg/mm².

SUMMARY

Studies have been made on the influence of delayed condensation upon the crushing strength of amalgam. The crushing strength decreases almost proportionally with the time elapsing from the finishing of the mix, on an average for the four different brands studied 50 kg per square centimeter per minute, i.e. 1.3 % per minute of the maximum strength. Therefore, the reduction in strength after a delay of e.g. five minutes is relatively insignificant.

RÉSUMÉ

ACTION DU RETARD APPORTÉ À LA CONDENSATION DE
L'AMALGAME SUR SA RÉSISTANCE À L'ÉCRASEMENT

Des études ont été faites sur l'influence que le retard apporté à la condensation de l'amalgame avait sur sa résistance à l'écrasement. La résistance à l'écrasement diminue à peu près proportionnellement au temps écoulé à partir de la terminaison du malaxage, soit en moyenne, pour les quatre marques différentes examinées, de 50 kg par centimètre carré par minute, c'est-à-dire 1,3 % de la résistance maximum par minute. Ainsi, la réduction de la résistance après un délai de par exemple cinq minutes est relativement insignifiante.

ZUSAMMENFASSUNG

DIE BEDEUTUNG DES STOPFBEGINNS FÜR DIE
BRUCHFESTIGKEIT VON SILBERAMALGAM

Über die Bedeutung des verzögerten Stopfbeginns für die Bruchfestigkeit von Silberamalgame sind Untersuchungen vorgenommen worden. Die Bruchfestigkeit nimmt ziemlich gleichmäßig der Zeit entsprechend ab, die nach Beendigung des Anrührens verstreicht, durchschnittlich für die verschiedenen Fabrikate um ca. 50 kg/cm²/min. oder 1,3 %/min. der anfänglichen Festigkeit. Die Verminderung der Bruchfestigkeit bei einer Verzögerung von z.B. 5 Minuten ist daher relativ unwesentlich.

REFERENCES

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