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Brief Clinical Note

Measurements of Change in Penile Dimensions

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INTRODUCTION

Jovanovic (1971) has reviewed several techniques used to measure changes in penile dimensions, commencing with kymographic recordings carried out by Ohlmeyer *et al.* (1944). These workers used a contact ring fixed to the penis and activated by erections beyond a minimum magnitude. Jovanovic discussed various forms of strain gauges, which measure changes in penile circumference (Fisher *et al.*, 1965; Bancroft *et al.*, 1966; Marks and Gelder, 1967) and also pointed out the use of a thermistor (Fisher *et al.*, 1965). He did not, however, mention the use of a plethysmograph, which measures volume changes (Freund, 1963; McConaghy, 1967).

It appears to have been accepted that these methods of measuring change in penile dimensions produce identical results. This would probably be the case if, as has been suggested, the penis has isotropic properties (Clark, 1972). This seems unlikely, however, in view of its anatomical structure. Variations in the volume of the glans must produce a large part of the plethysmographic response. There is no reason to believe that such variations would parallel changes in the corpora cavernosa which largely determine the circumference of the penis as measured by a strain gauge.

METHOD

In the course of routine studies in our laboratory, penile changes were measured in heterosexual and homosexual subjects, using both the plethysmograph previously described (McConaghy, 1967) and a mercury strain gauge simi-

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lar to those used by the workers referred to above. All changes were recorded on a Grass model 7B polygraph. For both responses, the "bridge 2K" setting was used on a DC preamplifier 7P1B. In order for an increase in penile dimension to produce an upward pen deflection, it was necessary that the polarity on the DC driver amplifier be set so that a negative voltage change produced an upward deflection in the case of the plethysmograph and a downward one in the case of the strain gauge. To maintain approximate equality of response size with the two transducers, the sensitivity needed to be somewhat greater for the strain gauge.

Responses were recorded while the subjects were conditioned with an appetitive and an aversive procedure. The appetitive procedure also provided evidence of the subjects' sexual orientation. With this, the subject watched a movie film in which were inserted, at minute intervals, 10-sec shots of female nudes alternated with 10-sec shots of male nudes. The conditioned stimuli were 10-sec shots of a red circle, which preceded the sequences of females, and 10-sec shots of a green triangle, which preceded the sequences of males.

A measure of the subject's sexual orientation was obtained by testing the significance of the difference between the magnitude of the penile volume responses to the pictures of the women and those to the men, using the Mann-Witney *U* test. *U* scores of 100 indicated that all responses to the women were greater than any to the men, the maximum heterosexual scores. *U* scores of 0 indicated the reverse, the maximum homosexual score.

In the aversive procedure, ten electric shocks of 1 sec duration and an intensity judged by the subject to be definitely unpleasant were delivered to the tips of his right index and ring fingers. A tone of 65 db intensity at 500 cycles/sec and of 10 sec duration preceded each shock. The tone-shock complex was delivered at 2-min intervals. One minute following each reinforced tone, a 10-sec tone of the same intensity but with a frequency of 1500 cycles/sec was sounded and not followed by a shock. Both procedures and the method of scoring penile responses have been described in more detail (Barr and McConaghy, 1971).

RESULTS

The following relationships were found between penile dimention changes as measured by the plethysmograph and the strain gauge:

1. The two responses largely paralleled each other. Figure 1 shows such a response in a heterosexual subject. The paralleling was never invariable, and at times one record would show an increase while the other showed a decrease, as with the response to the second triangle and male in this record. The *U* score for this subject was 100 as measured by plethysmograph and 96.5 as measured by strain gauge.

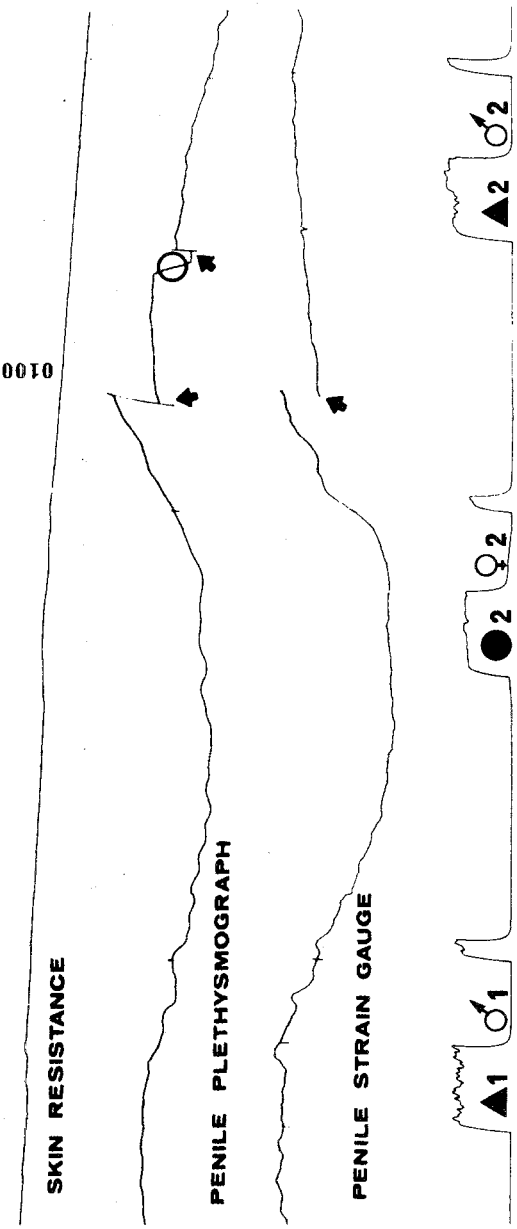

Fig. 1. Response of a heterosexual subject to the apetitive conditioning procedure. The plethysmograph was recorded initially at a sensitivity of 0.5 mv/cm. This was changed at the point indicated by the first arrow to 1.0 mv/cm and at the second arrow back to 0.5 mv/cm. The balance voltage was changed at the ringed section. The strain gauge was recorded at 0.05 mv/cm and changed at the arrow to 0.1 mv/cm.

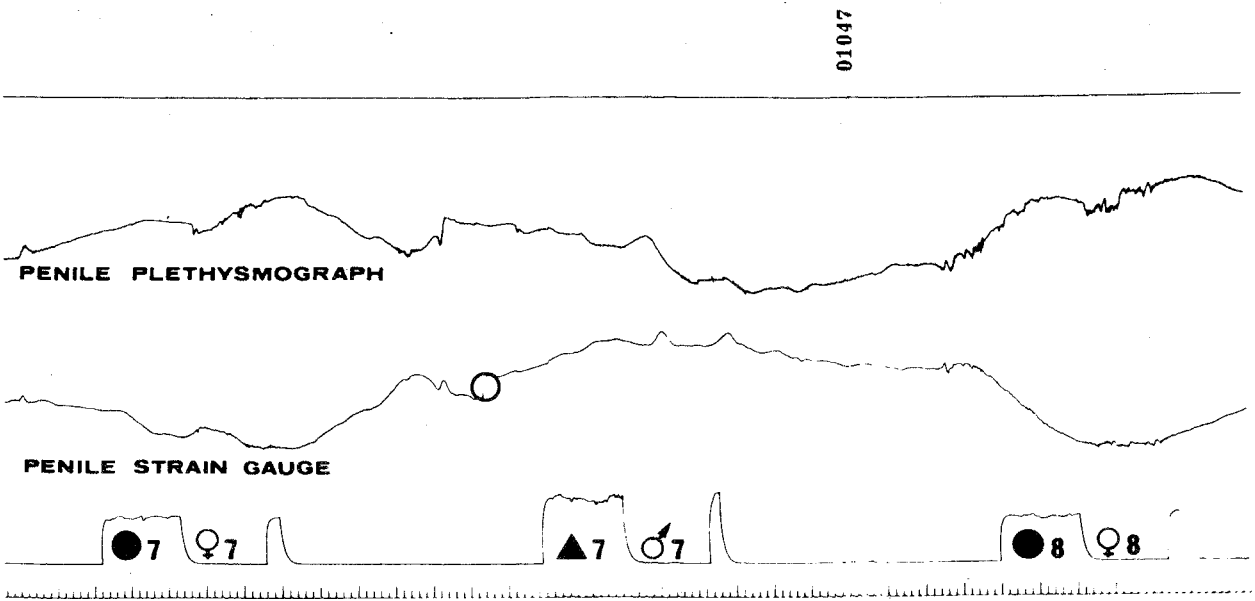

Fig. 2. Response of a heterosexual subject to the appetitive conditioning procedure. The plethysmograph was recorded at a sensitivity of 0.2 mv/cm, the strain gauge at 0.05 mv/cm. The balance voltage was changed at the ringed section.

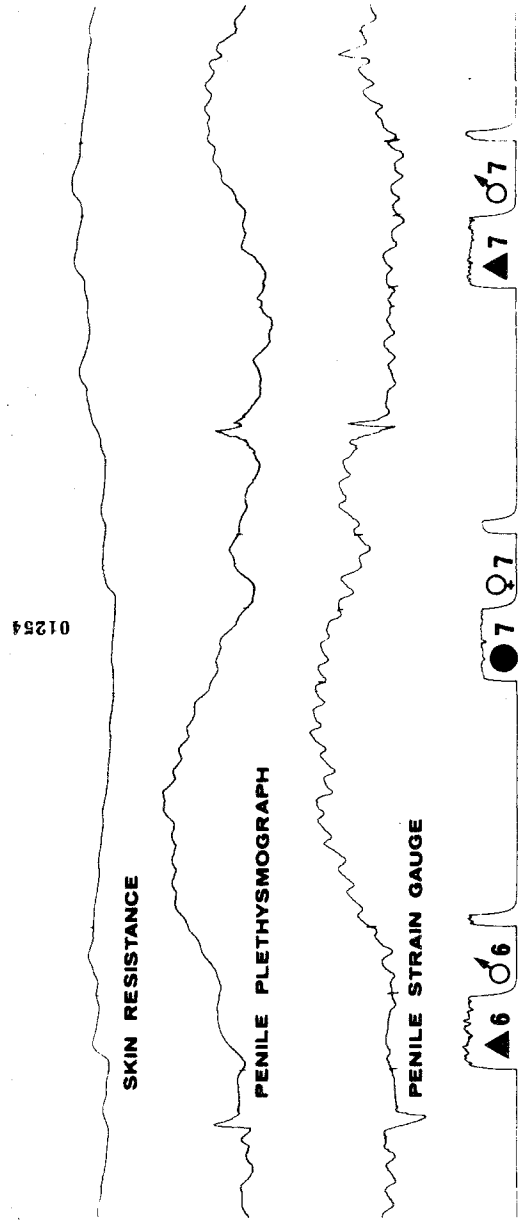

Fig. 3. Response of a homosexual subject to the appetitive conditioning procedure. The plethysmograph was recorded at a sensitivity of 0.5 mv/cm, the strain gauge at 0.1 mv/cm.

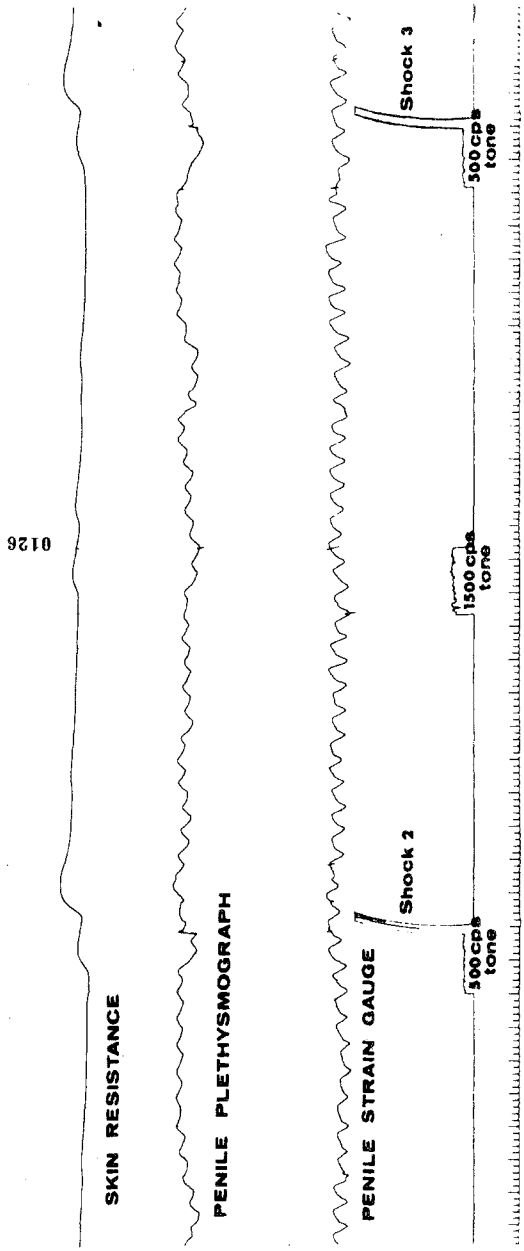

Fig. 4. Response of the same homosexual subject as in Fig. 3, during aversive conditioning. The sensitivities were unchanged.

2. The two responses were largely mirror images. Figure 2 shows this response in a heterosexual subject. This reversal of the responses was again never invariable, as will be seen in the record of the change to the seventh male and eighth female. The *U* score of this subject was 100 as measured by plethysmograph and 46.5 by strain gauge.

3. The latency of the response as measured by strain gauge was much greater than with the plethysmograph. This is apparent in Fig. 3, the record of a homosexual subject. The *U* score of this subject was 7 with the plethysmograph and 16.5 with the strain gauge.

4. Responses apparent in the plethysmograph record did not appear with the strain gauge. This was most frequent in regard to the response to the aversive stimulus as in Fig. 4.

CONCLUSION

There can be marked differences in the changes in penile dimensions measured by a strain gauge and those measured by a plethysmograph. At times, the changes can be opposite. The most probable explanation for this is that in some subjects changes in blood flow are not as rapid as changes in penile length. If the penis is increasing in length faster than its diameter can be maintained or expanded by the concomitant rise in blood flow, volume measurements such as by plethysmography will register in increase, while a strain gauge around the shaft will register a decrease.

This different change in penile dimensions may not yet have been of importance. Most workers would appear to be using the strain gauge to measure full erections (Bancroft *et al.*, 1966; Marks and Gelder, 1967) rather than the small penile changes of brief duration which have been studied with plethysmography (Freund, 1963, 1971; Barr and McConaghy, 1971). It is such penile changes which may not be apparent or may vary in latency or polarity if recorded with a strain gauge. However, in view of the differences in the measures of penile change reported in this paper it would seem advisable that a comprehensive study of methods of recording physiological evidence of genital arousal in the male should include techniques measuring volume changes. In the meantime, it would seem necessary that studies of penile responses be replicated using a similar measuring device.

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