

## Bone Mineral Density in Postmenopausal Women as Determined by Prior Oral Contraceptive Use

### ABSTRACT

The long-term consequences of prior oral contraceptive use for bone mineral density were examined in 239 postmenopausal women, 35.1% of whom reported prior oral contraceptive use. Women who had used oral contraceptives for 6 or more years had significantly higher bone densities of the lumbar spine and femoral neck, but not of the ultradistal wrist or radius, than women who never used oral contraceptives. (*Am J Public Health*. 1993;83:100-102)

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### Introduction

For the first time in history, large numbers of women who previously used oral contraceptives, with resultant higher-than-physiologic levels of estrogen and progesterone, are now postmenopausal. Oral contraceptives have been reported to have a beneficial effect<sup>1-6</sup> or no effect<sup>7-10</sup> on bone mineral density. Few studies have included variables, such as parity, age at menopause, and cigarette smoking, that affect both oral contraceptive use and osteoporosis. Furthermore, inclusion of premenopausal and recently postmenopausal women may have obscured associations by including women in different stages of bone loss.

We examined the association of prior oral contraceptive use to bone mineral density at four sites in a large, community-based sample of older postmenopausal women.

### Methods

Between February 1988 and April 1991, 239 women aged 55 to 69 years from a White, upper-middle-class Southern California community (Rancho Bernardo) participated in a study of osteoporosis. Information on reproductive and menstrual history, use of contraceptive and noncontraceptive estrogen, use of thiazide medications, and smoking history was obtained by standardized interview. Age at menopause was defined as age at last menstrual period for women with natural menopause, age at surgery for women who had a bilateral oophorectomy, or the sample's average age at natural menopause (49 years) for women who had a hysterectomy without oophorectomy.

Height and weight were measured with the participant in light clothing, with-

out shoes. Body mass index [weight (kg)/height (m)<sup>2</sup>] was used as an estimate of obesity.

Bone mineral density was measured at the lumbar spine (L1-L4) and hip (femoral neck) using dual x-ray absorptiometry (Hologic QDR model 1000, Waltham, Mass), and at the midshaft of the radius and ultradistal wrist of the nondominant arm using single photon absorptiometry (Lunar model SP2B, Madison, Wis). Among the 239 women, 225 bone density measurements were available for the ultradistal wrist and midshaft radius, 234 for the femoral neck, and 237 for the spine. Missing values represent subject fatigue, down time for the scanner, or other technical difficulties.

Comparisons of bone mineral density by duration of use (never, 1 through 5 years, 6 or more years), adjusted for age and for age and body mass index, were computed using analysis of covariance.<sup>11</sup> Multiple regression analyses<sup>12</sup> were used to examine the effect of duration of use (contrast coded to compare women who never used oral contraceptives with women who used them for 6 or more years and with women who used them 1 to 5 years) on bone mineral density at each of the four sites, after adjustment for the potentially confounding covariates of age, body mass index, years postmenopausal, cigarette smoking, and estrogen and thiazide use. All statistical tests are two-tailed.

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## Results

The average age of these 239 women was 63.3 years; 35.1% reported past oral contraceptive use. Duration of use ranged from 1 to 15 years, with an average of 4.1 years; 155 never used oral contraceptives, 63 used them 1 to 5 years, and 21 used them 6 or more years. Comparisons by duration of use (Table 1) indicated that women who used oral contraceptives were significantly younger ( $P < .001$ ) and more recently postmenopausal compared with never users ( $P < .001$  for the comparison with users for 6 or more years). In addition, women who used oral contraceptives were somewhat heavier ( $P < .06$ ) and more parous ( $P < .07$ ) than never users.

Compared with women who never used oral contraceptives (Table 2), those who used them for 6 or more years had higher bone mineral densities of the femoral neck ( $F = 5.49$ ,  $P < .05$ ) and spine ( $F = 5.30$ ,  $P < .05$ ). These differences changed very little after adjustment for potentially confounding covariates ( $F = 4.74$  for femoral neck and  $F = 4.01$  for spine;  $P_s < .05$ ). No significant differences were found in ultradistal wrist or midradial bone densities. In separate analyses, parity was unassociated with bone density at any site in this cohort.<sup>13</sup>

## Discussion

Postmenopausal women who used oral contraceptives for 6 or more years had significantly greater spine and femoral neck bone densities than women who never used oral contraceptives. These associations were not explained by age, body mass index, parity, cigarette smoking, years postmenopausal, or use of estrogen and thiazide medications, and they were strong enough to be detected despite the small sample of long-term oral contraceptive users. It is unlikely that oral contraceptive use led to later age at menopause and thereby to higher bone density, as there was no difference in age at menopause by oral contraceptive use. Although oral contraceptive use was based on self-report, others have found good agreement between medical records and self-reported past use of medication.<sup>14</sup>

In accord with the present study, Stevenson et al.<sup>6</sup> and Lindsay et al.<sup>4</sup> found that oral contraceptive use was associated with greater bone mineral density of the spine than of the radius. The increased femoral neck density was similar to previous reports.<sup>3,6</sup>

TABLE 1—Comparisons of Participants Who Used Oral Contraceptives for 1 to 5 Years and 6 or More Years and Those Who Never Used Oral Contraceptives

	No Oral Contraceptive Use (n = 155)	Oral Contraceptive Use, y		F or $\chi^2$	t contrast or $\chi^2$	
		1–5 y (n = 63)	6+ y (n = 21)		0 vs 1–5 y	0 vs 6+ y
Age, y	64.1	62.2	60.4	10.78 <sup>a</sup>	3.16 <sup>b</sup>	3.93 <sup>a</sup>
Body mass index, kg/m <sup>2</sup>	24.9	25.8	26.7	2.47 <sup>c</sup>	1.47	1.91 <sup>d</sup>
Smoking, %	53.9	55.6	47.6	0.40	0.05	0.29
Ever used estrogen, %	78.7	76.2	76.2	0.20	0.17	0.07
Current use of estrogen, %	52.3	47.6	47.6	0.47	0.38	0.16
Age at menopause, y	46.3	46.3	48.6	1.22	0.07	1.52
Years postmenopausal	17.7	15.9	11.8	6.12 <sup>a</sup>	1.61	3.35 <sup>a</sup>
Thiazide use, %	7.7	6.3	15.0	1.58	0.13	1.19
Parity	2.7	3.5	3.0	2.76 <sup>e</sup>	2.35 <sup>f</sup>	0.48

Note. Comparisons were made using analysis of variance for continuous variables and  $\chi^2$  analysis for categorical variables.

<sup>a</sup> $P < .001$ .  
<sup>b</sup> $P < .01$ .  
<sup>c</sup> $P < .08$ .  
<sup>d</sup> $P < .06$ .  
<sup>e</sup> $P < .07$ .  
<sup>f</sup> $P < .05$ .

TABLE 2—Adjusted Comparisons of Mean Bone Mineral Density at Different Sites, by Duration of Prior Oral Contraceptive Use

Bone Mineral Density Site	Oral Contraceptive Use, y	n	Adjusted for Age	Adjusted for Age + Body Mass Index	Multiply Adjusted
Ultradistal wrist	0	144	0.25	0.25	0.25
	1–5	60	0.25	0.25	0.25
	6+	21	0.26	0.26	0.25
	F		0.23	0.10	
	0 vs 1–5 y		0.36	0.31	0.11
	0 vs 6+ y		0.53	0.26	0.06
Midradius	0	146	0.66	0.67	0.67
	1–5	58	0.65	0.65	0.66
	6+	21	0.68	0.65	0.67
	F		0.60	1.26	
	0 vs 1–5 y		0.97	0.62	0.54
	0 vs 6+ y		0.20	0.04	0.08
Femoral neck	0	144	0.68	0.68	0.68
	1–5	60	0.66	0.66	0.65
	6+	21	0.75	0.73	0.72
	F			2.45*	2.23
	0 vs 1–5 y		2.28	2.16	2.07
	0 vs 6+ y		5.49**	4.06**	4.74**
Lumbar spine	0	153	0.92	0.92	0.92
	1–5	63	0.90	0.90	0.89
	6+	21	0.98	0.96	0.96
	F		1.75	1.45	
	0 vs 1–5 y		1.02	1.29	2.13
	0 vs 6+ y		5.30**	3.83**	4.01**

Note. Contrasts for the means adjusted for age and for age and body mass index were computed with analysis of covariance. Contrasts for the multiply adjusted means were computed with multiple regression and adjusted for age, body mass index, years postmenopausal, estrogen use, thiazide use, and cigarette smoking.

\* $P < .09$ .  
\*\* $P < .05$ .

Others have also found a positive effect on bone mineral density only with long-term use of oral contraceptives.<sup>1,4,15</sup> Information on the dose of oral contraceptives was not obtained in the present study. Goldsmith and Johnston<sup>2</sup> found that improved bone mineralization was associated with oral contraceptives containing mestranol in a dose of 100 µg daily, but not with those containing lower doses of mestranol or ethyl estradiol. In the present study, women who took oral contraceptives for the longest period of time very possibly used higher estrogen contraceptives. The long-term effect of current lower dose oral contraceptives is unknown.

Enhanced bone mineralization among contraceptive users is biologically plausible; estrogens increase calcium absorption, decrease calcium loss, and have a direct effect on bone resorption.<sup>16-18</sup> By delaying or preventing the decline in bone that begins between ages 30 and 40, these women would enter menopause with greater bone mass. This possibility warrants further investigation. If use of oral contraceptives for 6 or more years reduces the risk of postmenopausal bone loss, the public health impact could be large. □

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